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VIEWS, NEWS AND INTERVIEWS.

Mr. Enos M. Barton, president of the Western Electric Company, Chicago, has been elected a trustee of the University of Chicago. He is an enthusiastic believer in the future of the university and is a close friend of President Harper.

The battleship "Wisconsin," the latest addition to our navy, embodies all the electrical features that have been experimentally tried in the older vessels. Her electrical equipment consists of an incandescent lighting system, four large searchlights, apparatus for the operation of the two large turrets, electrical ammunition hoists and powerful electrically propelled fans for the elaborate ventilating system.

The wonderful growth of the telegraph business is shown in the fact that 30 years ago there were only 3,000 telegraph offices and little more than 75,000 miles of wire strung throughout the length and breadth of the land. At the present time there are about 25,000 offices and over 1,000,000 miles of wire. The annual number of messages handled 30 years ago was 5,879,282; to-day it is 80,000,000. The average cost to the sender 30 years ago was $1.04.7; the average cost to-day is 30.9 cents. At the start the cost to the company was more than twice what it is to-day to the sender.

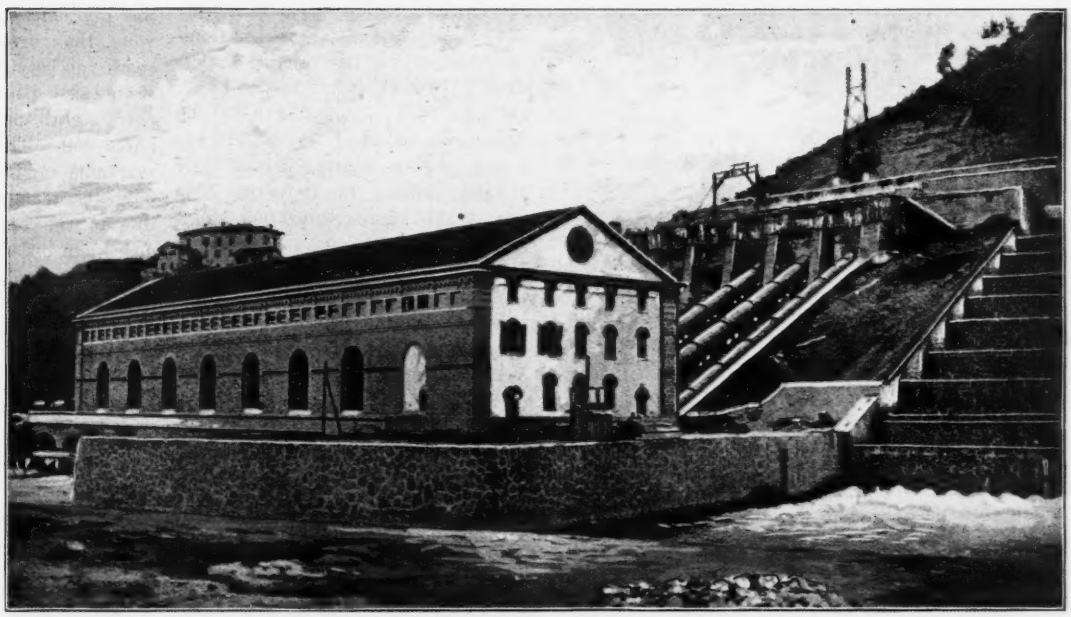
It has been announced that the secret of Keely's motor died with him and that his friend, Mr. T. B. Kinraide, of Jamaica Plain, Mass., who was more or less familiar with Keely's theories, will devote a year to endeavoring to produce a practical device, based on Keely's ideas. Fortunately, Mr. Kinraide has adopted a policy of silence and makes no promises as to when he will produce something practical, if at all. He will work without compensation, so it is reported. Mr. Kinraide has an extensive and well appointed experimental laboratory at Jamaica Plain and has done considerable work in the electrical field, more especially in connection with the X rays. Under the name of the Spring Park Laboratory, Mr. Kinraide placed on the market a series of X-ray tubes.

It is stated that aluminum wire will be used for new telephone and telegraph lines to be erected in Manila.

Michael P. O'Connor, a New York lawyer, has been indicted for subornation of perjury in suits against the Third Avenue Railroad Company and other street railway corporations in New York. One of his schemes was to educate young children by instructing them as to their testimony and placing them on the witness stand in damage suits. In order to thoroughly drill them he had in his office models of cars and rails, wagons and trucks, which he used to illustrate the points he desired them to bring out in their story on the witness stand.

Although the drought of the last year in California has been so disastrous to mining interests and will reduce the state's output of gold by many hundreds of thousands of dollars, a few of the big properties have been able to keep their production up to their usual amount. According to a dispatch from Los Angeles, it has caused the increased development of water in many districts and has induced many mine owners to supplement water-power with electricity, so that it has been of some benefit in leading to an increase in the means of production.

A strike of the telegraphers of the country is threatened. Howard Gould, who is a telegrapher, will probably not go out, however. Mr. Gould is very busily engaged now in trying to eke out an existence on the $5,000,000 he fell heir to when he reached his twenty-first birthday a few days ago, and he can't afford the risk of losing his job.—*Plainfield, N. J., Press.*



AN ITALIAN WATER-POWER ELECTRIC STATION AT PADERNO.

An Italian Water-Power Electric Plant.

In the illustration on this page is shown an exterior view of the electric power-station at Paderno, Italy, which is operated by water-power, and supplies electric current to Milan. From here 13,000 horse-power is transmitted a distance of 20 miles. The late Professor Galileo Ferraris was the advising engineer of this plant, which, to the American mind, is of a rather complicated character. Advantage was taken of the existing work on the canal regulator of the Naviglio of Paderno several hundred yards down stream from the famous bridge of the same name. In order to convey 10,000 gallons of water, the existing weir had its upper part rebuilt and the channel was enlarged from 30 feet to 43 feet so as to be able to convey 10,000 gallons of water with a velocity of four and one-half feet per second. Included in the water-way is a canal 115 yards long which emerges into a deep trench 26 feet wide and 273 yards long. Then follows a second canal of 202 yards, a second trench of 385 yards, and finally a tunnel 1,100 yards long. This makes in all a length of 2,448 yards. The volume of water has a cross-section of 180 square feet, and for the delivery of 10,000 gallons the velocity is 8.9 feet per second. An ample penstock collects the water, which enters the pipes with a velocity of about 3.3 feet per second. At one side of the penstock is the head of the weir, which is large enough to dispose of 11,440 gallons of water. It is formed of a flight of steps 95 feet high and 98 feet wide. The mass of water which runs down it is thus divided and broken up until

the enormous energy which it possesses is entirely spent.

The pipes which convey the water to the turbines are seven in number, and are 6.9 feet in diameter. They are made of riveted steel plates, are 215 feet long, and are laid to suit the natural slope of the ground. At the top a sluice gate, electrically controlled, shuts off the admission of water, and at the bottom a butterfly-valve prevents the flow of the water towards the turbine. From the turbine the discharge takes place into a wide tail-race, which communicates with a separate canal. The net fall in the dry season is 94.5 feet. In times of flood this is reduced to 81.6 feet, and the power represented at 10,000 gallons of water per second with a fall of 94.5 feet is equal to 17,300 horse-power, which, with a turbine efficiency of 75 per cent, gives nearly 13,000 horse-power actual output. The station is divided into six units of 2,160 horse-power each, while a seventh is added as reserve.

Considering the great variability in the level of the tail-race, it was necessary to have recourse to suction turbines. The part of the fall which acts by pressure is 75 feet, and that by suction is 19.5 feet in times of greatest drought, and 6.6 feet in times of flood. With such a division of the fall it is possible to keep the floor of the dynamo-room above the level of the highest flood, which is a matter of great importance.

The turbines, manufactured by a Milan firm, are of the inward-flow type with twin wheels. The bearings are outside the water chamber, so that they may be easily examined when the machines are running. The turbines make 180 revolutions per minute, and each has a maximum capacity of 1,916 gallons per second. Each turbine is connected to an alternating-current generator by means of an elastic coupling. The illustration on the preceding page is reproduced from the London *Electrician*.

The South American General Electric Supply Company.

An auxiliary company to the General Electric Company has just been organized at Schenectady, N. Y., and incorporated at Albany, under the name of the South American General Electric Supply Company, with a capital of $50,000. This company will be exclusively engaged in the export to and sale in the southern part of South America of the electrical supplies, lamps, etc., made at the Schenectady works. It will not deal in electrical machinery. That branch of the business will continue to be handled by the foreign department of the General Electric Company.

Telephone News .....and Comment

Senator Allen has introduced a bill in Congress for the establishment of a government postal telegraph system.

The United Telegraph, Telephone and Electric Company, Chicago, has certified to an increase in the number of its directors from five to nine.

The Central & South American Telephone Company has declared a quarterly dividend of one and one-half per cent, payable January 6. Books closed December 28; open January 7.

Springfield, Ohio, has fallen into the idea of the independent telephone lines, and recently a company from that city was incorporated to do business on a capital stock of $50,000. The company is backed by I. Ward Frey, Robert C. Gotwald, C. H. Pierce, E. C. Gwynn and Robert Mills.

Twenty-five representatives of independent telephone exchanges in Illinois and Indiana held a meeting recently at Paris, Ill., at the instance of the Central Union Telephone Company, to discuss a proposition looking to the interchangeable use of its lines with those of the independent companies.

A series of new telegraph and telephone cables are to be laid at once in San Francisco bay by the government. One of the lines is to stretch between Fort Mason on the north side of the bay to Angel Island, thence one will be laid to Alcatraz. The Presidio and Fort Baker are also to be connected.

The Central Union Telephone Company recently secured a new franchise in Peoria, Ill., running for 30 years, and allowing it to charge the same rate as now prevails. The company promised to put its wires underground downtown, spent $100,000 on improvements, greatly improved the service, and has now voluntarily reduced rentals on all classes of service from 10 to 35 per cent.

The New England Telegraph and Telephone Company last week inaugurated a new telephone service by which it is prepared to establish at residences or places of business located within the Boston or suburban exchange districts and accessible to the company's wires long-distance telephones, measured service basis, as follows: Residences, six on a circuit, $30 per annum; business, three or more on a circuit, $48. An extra charge is made for stations located more than one mile from the company's exchange office.

At the annual meeting of the Board of Trade, of Washington, D. C., a resolution was passed authorizing the appointment of a special committee of five to confer with the commissioners for the purpose of securing the enforcement of the law reducing tele phone rates in the District of Columbia. This committee is as follows: F. L. Siddons, chairman; Geo. W. Knox, J. B. Lambie, Samuel Ross and W. H. Moses.

The American Bell Telephone Company has sold $3,000,000 four per cent 10-year debenture bonds to R. L. Day & Company and Estabrook & Company, jointly. The price is understood to have been 102.32. The bonds are part of an issue of $10,000,000 debentures, of which $5,000,000 was issued in June, bearing date of July 1, 1898, running for 10 years. The sale of the above $3,000,000 bonds leaves but $2,000,000 to be issued. It is believed that the future needs of the American Bell Telephone Company will call for the issue of $10,000,000 bonds a year. The company has not as yet disposed of 1,500 shares of stock which it is at liberty to sell by auction.

A bill has been signed by Mayor Quincy, of Boston, granting the Massachusetts Telephone–Telegraph Company, which is associated with the Boston & New York Telephone–Telegraph Company, recently incorporated in New Jersey, the right to construct and operate service in that city, with provisions guaranteed by the company that construction will be begun by July 1, 1899, the lines to be in operation in two years. The new company must furnish as good service with as low rates as the New England Telephone and Telegraph Company, at a cost of not more than $6 monthly, must lay wires under ground, Boston to have free use of ducts for fire and police wires. It must not sell out to any other concern. It is understood that Zephaniah S. Holbrook, of Cambridge, will be president. Others prominently interested are Oakes Ames, Milton, Mass.; Frederick A. Spear and Charles E. Adams, Lowell, and J. Stewart Rusk, Boston.

HIGH-VOLTAGE POWER TRANSMISSION.

READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, OMAHA, JUNE 30, 1898, BY CHAS. F. SCOTT.

(Continued from page 410.)

6. It was noticed that, when there was a breakdown upon the line and the current passed suddenly between wires over the surface of the cross-arm, there was a sparking between the terminals of the ammeters in the high-tension circuit across the surface of the instrument. This was further investigated by placing in circuit a coil of low resistance, through which one ampere would be sent by about one and one-half volts at a frequency of 125. A spark-gap was placed in shunt to this coil. A two-inch spark-gap was also placed between the line wires. The voltage of the primary was gradually raised until, at 35,000 volts, the current passed across the spark-gap between the line wires. A spark also passed across a gap of three-eighth inch, shunting the small choke coil. This test shows the remarkable suddenness of the rush of current when the short-circuit occurs, due to the breaking down of the spark-gap on a high-voltage circuit. This phenomenon was observed by Mr. Mershon in choke coils used in connection with lightning arresters at Telluride.

Running tests were made on four lines in multiple at high voltages. Each line consisted of two wires 1,040 feet in length held by 26 insulators. The insulators were of various types of glass and porcelain, some of the ordinary form and some underhung. For hours at a time 100,000 volts or slightly more were kept upon the line. For about six weeks voltages ranging from 70,000 or 80,000 to 100,000 volts were kept on the lines for about eight hours a day. When there was rain the line would short-circuit and the voltage had to be reduced. During a driving rain-storm 48,000 volts was kept on the lines, and it may have required a considerably higher voltage to have caused short-circuiting.

7. A high-tension wattmeter, similar to the Thomson wattmeter at Telluride, was used. To correct the wattmeter for the errors caused by charging current in the shunt resistance, a condenser was placed in parallel to the shunt-circuit of the wattmeter. This condenser should be so adjusted that the current through the shunt circuit of the wattmeter is the same that it would be if there were no condenser and the shunt resistance had no capacity. This permits the capacity current in the circuit to be shunted round the wattmeter by the condenser. The con-

denser in shunt to the wattmeter was capable of adjustment, and by varying its capacity the deflection could be made positive or zero or negative when current was delivered to a constant load. The proper adjustment was made by taking a comparatively low voltage, at which the charging current was very high in comparison with the loss, so that the loss was nearly negligible, and adjusting the wattmeter to indicate zero. At higher voltages, when there was a considerable loss, the error with this adjustment would be inappreciable. Certain variations with temperature and humidity were noted which would be explained by a variation in the capacity of the resistance, causing a variation in the charging current to the shunt circuit of the wattmeter. The high resistance for the shunt circuit was wound upon fuller-board plates containing brass stiffening pieces. Tests were made upon individual plates by measuring the capacity between the wire and the supporting strip of brass, and it was found that the capacity and the insulation resistance both varied with the amount of moisture in the fuller-board insulation. In order to prevent variations of this kind subsequent resistances were wound upon glass plates, which seems to be a very satisfactory form of construction.

Tests at Niagara—Some measurements have been made upon the Niagara-Buffalo transmission line. There are two circuits of three wires each, one of which was in service and the other was available for tests. Each circuit consists of three cables, each of 350,000 circular mils, approximately 0.7 inch in diameter. The cables are run on porcelain insulators, and are on the same cross-arm. Adjacent insulators are 18 inches apart and the circuit is spiraled, so that each of the three wires occupies the middle position for a third of the distance. Current from one of the 5,000-horse-power generators was applied to the line through a raising transformer, by which the voltage can be increased by small steps to 100,000 volts. This transformer is part of a high-tension testing outfit which is described by Mr. C. E. Skinner in the *Electrical World*, March 5, 1898. The wattmeter is a Thomson inclined coil instrument with a high resistance shunt of German silver wire wound on glass plates. The ammeter is a Thomson inclined coil instrument, connected directly in the high-voltage circuit.

Measurements were made between the various pairs of wires; i. e., 1 and 2, 2 and 3 and 1 and 3; the current was found to be practically the same in each case; the loss on one of the circuits was slightly greater than that on either of the other two, on which the losses were about equal. The accompanying curve shows the measurements of current when two wires were connected and the measurement of loss; the latter measurements were made upon one pair of wires up to about 26,000 volts and then upon a second pair. The results are given in Fig. 14.

On another day, measurements were made of the resistance between each wire and the ground, and corresponding measurements of loss were made by placing the high potentials between each wire and the ground. The measured loss was somewhat greater than the loss calculated by using the electro-motive force and the measured resistance. In these measurements, at voltages from 13,000 to 23,000 volts, the power factor, calculated from the current and wattmeter measurements, varied from about four per cent to six per cent, so that a very small charging current in the wattmeter would produce a considerable error in the reading.

Some measurements were made upon

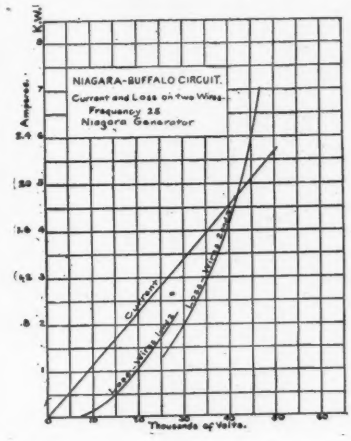


FIG. 14.—"HIGH-VOLTAGE POWER TRANSMISSION"

a pair of fine wires, in which the wires were placed at different distances apart. No. 31 Brown & Sharpe gage spring brass wire 0.0089 inch in diameter was used. The length of the parallel wires was 744 feet. They were suspended by light strings successively at six inches apart, 14 inches apart and about 25 inches apart, the distance varying from 24 inches to 37 inches. The wattmeter readings are given in the curves in Fig. 15. The power factor of the measurements made above 100,000 volts is about 95 per cent, and is over 80 per cent above 70,000 volts. There can be but little error in the wattmeter due to charging current in the resistance at these power factors.

The measurements on the Buffalo line were made by the writer. Those on the fine wires were made by Mr. E. M. Tingley, who conducted the tests at East Pittsburgh and rendered valuable assistance in the preparation of this paper.

Power Transmission Plants in Operation—Beginning with the plant at San Bernardino and Pomona, which began operation in 1892, using 10,000 volts and transmitting 30 miles, a constantly increasing number of plants have been installed, operating at 10,000 or 15,000 volts. In some cases there has been little or no trouble experienced with the transmission lines, while in other cases the experiences have been less satisfactory. The principal trouble seems to have been a poor grade or an insufficient size of porcelain insulator. In other cases the insulators, sometimes porcelain and sometimes glass, have given almost perfect satisfaction.

The superintendent of a power company, which has been running 15 months with about 15,000 volts, reports that they "have had absolutely no trouble whatever of an electrical nature." Some insulators were broken because they had been used as targets by small boys or hunters, but only the outer petticoats were broken, and no short circuits occurred, although, in some cases, insulators were in use for months with most of the outer petticoats chipped off. The distance of transmission is 12 miles. Porcelain insulators are used.

In another plant which has been in operation about a year and a half, employing 15,000 volts for a distance of nearly 30 miles, there have been but three shut-downs on account of line difficulties. These were due to the breaking of insulators at a point where the line was spiraled. In one case the repair was made in half an hour, and in the other case a few minutes' interruption to the service was sufficient for repairs.

The line is regularly patroled, and if a defective insulator or pin is found, the generating station is notified by telephone and the line is shut down for a few moments at noon. In one case two poles were burned by a defect in the insulators on the top of each. The poles burned to the ground, leaving the line hanging clear without any one at either the generating station or sub-station being aware of the fact.

Troubles have arisen on some lines by the burning off of pins by the

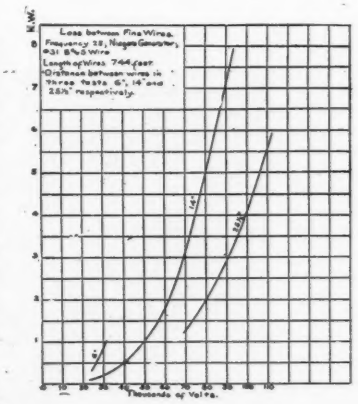


FIG. 15.—"HIGH-VOLTAGE POWER TRANSMISSION."

passage of sparks from the outer edge of the insulator to the pin. These sparks make small holes in the pin no larger than a needle point, but after continuous sparking for some time the pin becomes entirely charred. An iron pin suggested itself as a remedy, but additional strains and liability to breakdown are liable when a conductor is placed within the insulator. The burning off of pins has occurred where small porcelain insulators are porous and the outside glaze is imperfect, while the glaze on the inside is good. When the porcelain is filled with water the current readily passes through it to the lower rim of the insulator and then sparks across to the pin. In one place which has been running for about three years some 250 pins burned off. The early insulators have been replaced by larger and better ones, and this defect has disappeared.

A 10,000-volt line which runs for a dozen miles or more within a few hundred yards of the Pacific coast has burned cross-arms on nearly every pole. The cross-arms near the ends of the line, which are away from the coast, are not burned. Usually the burning appears as a mere blackening of the cross-arm for a short space between the insulators, on one side of the arm. In some cases the charring is deeper, and appears on both sides. The side on which almost all of the burning occurs is the one toward which the winds come from the ocean, bearing the mist of salt-water. The wire shows discoloration, and the iron braces for holding the cross-arms are in a few cases eaten through. Moreover, the cross-arms were green and full of sap when erected. The early porcelain insulators were porous, and have now been replaced, and the pins are of iron. The charring has ceased almost entirely since the new porcelains were put up.

It may be observed that in the plants which are herein referred to, and in the experimental tests, no mention has been made of insulators with cups containing oil for reducing the surface leakage. Insulators of this kind were used in the Frankfort–Lauffen experimental transmission line at 30,000 volts. Practically, however, the surface insulation is adequate without oil cups, and the principal duty of the insulator is to prevent the current passing over the surface and jumping to the pin or cross-arm, a matter with which the oil would have nothing to do.

Telephone lines are in use in a number of plants, placed on the poles which carry the transmission wires. The telephone lines are usually placed some distance below the transmission wires and are crossed at frequent intervals. The telephones in general work very satisfactorily.

There appears to be practically nothing in power transmission in Europe using high potentials outside of Switzerland. The installation in Paderno, in Switzerland, is operating at 15,000 volts, the highest voltage which has been used in that country. The damp weather is one of the limiting factors. The insulators used are porcelain, with a triple petticoat.

(To be concluded.)

Newark Technical School.

The Newark Technical School, 367 High street, Newark, N. J., has issued its new handbook of information for 1898–99. It contains a full description of the school, and of the various courses of instruction which it provides. The handbook may be obtained by writing to the above address.

A MODERN ARC LAMP FACTORY.

THE PLANT OF THE STANDARD THERMOMETER AND ELECTRIC COMPANY AT PEABODY, MASS.

The building occupied by this company, situated on the square in Peabody, close to the heart of the town, was built about 50 years ago by the grandfather of the principal owners of the company. It has been occupied by the Standard Thermometer and Electric Company, and by its predecessor, the Standard Thermometer Company, for the last 15 years. All of this time the manufacture of thermometers has been prosecuted, and for the last nine years the company has been making arc lamps. The building is 50 feet by 60, and its four stories and basement are entirely occupied by the works of the company, as well as two stories of an annex, 20 feet by 40.

In the basement are the boiler and engine, the latter a 50-horse "Fitchburg." Besides these, there are the blacksmith's forge and the annealing and brazing forge in one corner. There are four dynamos in the basement, purring away all the time in their own glass-sided room; one a 110-volt multipolar for shop lighting and lamp testing; another an alternating dynamo, rigged up with change of speed counter, in order to test out lamps of different frequencies; another is a convertible 220-volt or 550-volt machine for testing direct-current lamps of these voltages; the last is a series machine, for either 6.8 amperes or 10 amperes, or anything between; this is used for testing and adjusting the constant-current lamps.

On the other side of the basement is a line of presses and a drop hammer, where the drawn and punched work of the factory is done. There is a polishing and plating plant in the basement, where the finishing of cases for the lamps and thermometers and the plating of the working parts and inside portions of the lamps are done. The plating current is supplied by another dynamo.

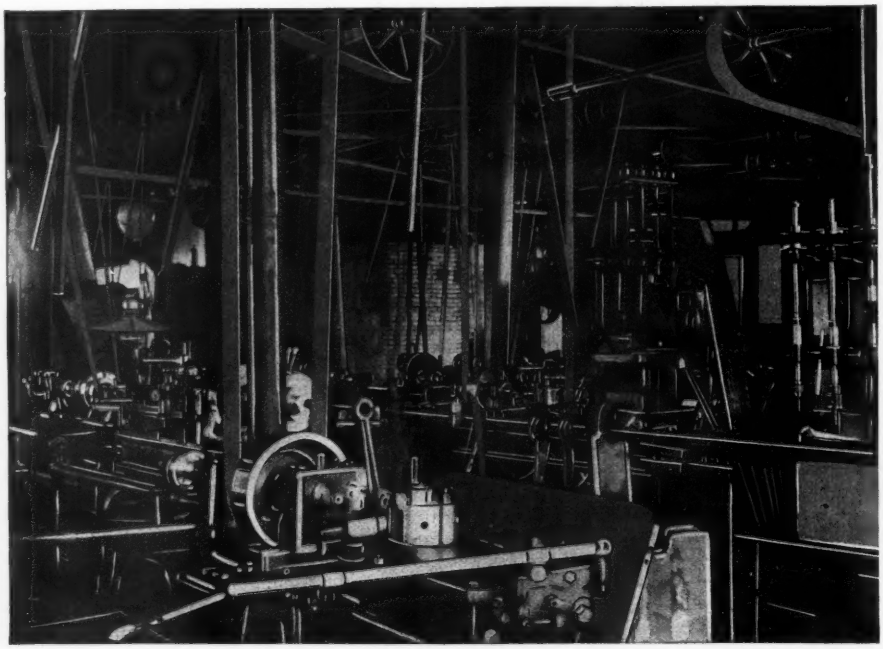


FIG. 1.—A GROUND FLOOR VIEW IN THE FACTORY OF THE STANDARD THERMOMETER AND ELECTRIC COMPANY.

On the first or ground floor we find the office, which takes up about one-fourth of the space. The illustration gives a little idea of the character of the machinery in the remainder. The heavier lathes, drills, planers, etc., are on this floor, and the heavier work on the arc lamps is done here. Here, too, is the case-making shop, where the arc lamp cases are made and the thermometer cases assembled. The cases for both thermometers and arc lamps are now made entirely at the factory, doing away with delays formerly experienced when depending upon outside shops for cases. On the second floor the finer and lighter machines are placed. There is a range of watchmaking tools on one side of the room, used in the manufacture of thermometers, and seen on the right in the cut, Fig. 2; then comes a row of tools somewhat heavier, in which the small parts of the arc lamps are made, and back of these are spinning lathes, speed lathes, milling machines, turret lathes, automatic screw machinery, etc., as well as a toolmakers' department, where the special tools are made for the entire factory. In the annex on this floor are the japanning ovens, heated by gas and controlled by the special japanners' oven thermometers, made by the company. In the annex are also a small special tool-room and the room where telemeters are assembled and standardized.

On the third floor is the stock-room, the shipping-room and the arc-lamp testing-room. The stock-room is one of the busiest places in the whole shop. Here all the material is received, counted, weighed or measured, and from this room the raw material of all kinds goes out to the different workmen as called for. As each part, whether for thermometer or arc lamp, is finished it goes back to the stock-room and is held there till needed in the assembling-room. Besides keeping trace of the work in progress, the stock-keeper has to keep with each employé of the company a tool account. The company owns all the tools used by the men, and allows no one to bring any tools whatever into the factory. It is needless to state that the stock-keeper has not much spare time.

The arc-lamp testing room on the same floor is one of the most interesting places in the whole shop to the electrician. There are three separate

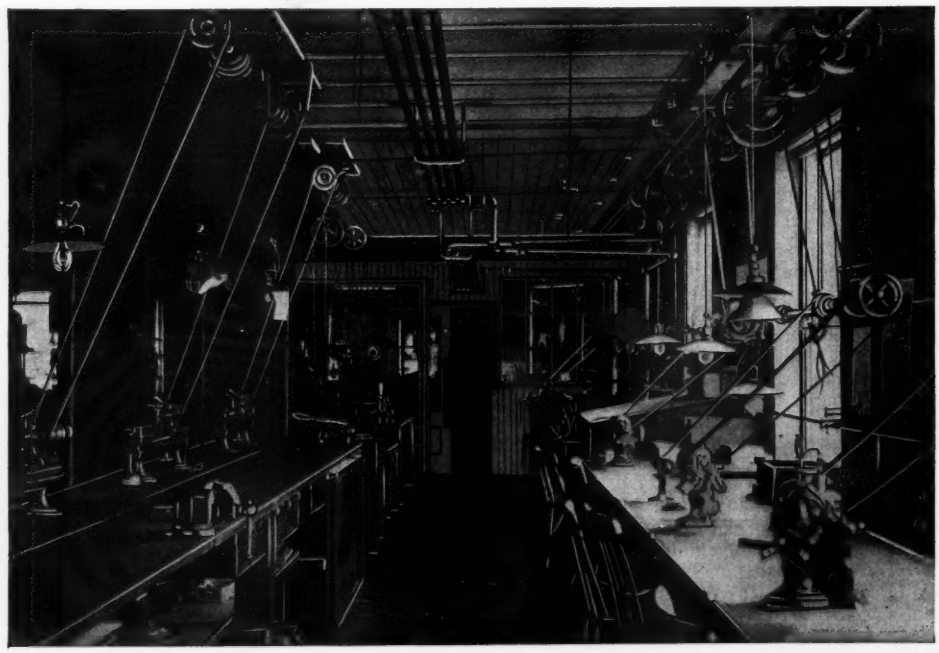


FIG. 2.—WATCHMAKING TOOLS ON THE SECOND FLOOR OF THE STANDARD THERMOMETER AND ELECTRIC COMPANY'S FACTORY.

switchboards in this room, one for the alternating current, equipped with racks for testing open alternating-current lamps and with instruments for controlling the alternating dynamo in the basement. The second board, a corner of which is shown in the cut, Fig. 4, carries the controllers for the multipolar direct-current dynamo in the basement, used for lighting the shop and for testing the 110 volt lamps, either open or enclosed. For the testing of enclosed arc lamps there are ranges of drops into which the lamps can be connected and to which current can be run from either the alternating-current board or the direct-current board at will. This diversion of current, as well as the handling of the high-tension currents, is done by means of the third switchboard. This board is equipped with a complete set of throw-over switches, by which any of the lamps can be connected to the recording instruments or to the indicating voltmeters, ammeters or wattmeters at the will of the operator. The exact current consumption can be determined and the necessary adjustments made very readily.

The company makes arc lamps for all sorts of currents, open and enclosed; they have lamps for direct currents of 110 volts to 220 volts, burning in multiple; for 220 volts to 550 volts, burning in series-multiple; for constant current of four to seven amperes, for alternating current of frequencies of 7,200 to 16,000 alternations per minute and have to be prepared to test them all, hence the need of the multiplied apparatus in the testing-room. In addition to the current generated on the premises, wires from the town plant are led into the testing-room and a good many of the lamps are run on this current for continuous records and for testing. The current being of 16,000 alternations on the one hand and 6.8 amperes of constant current on the other, the testing of these lamps can be proceeded with at times when the rest of the factory is shut down. This in rush times is a great convenience.

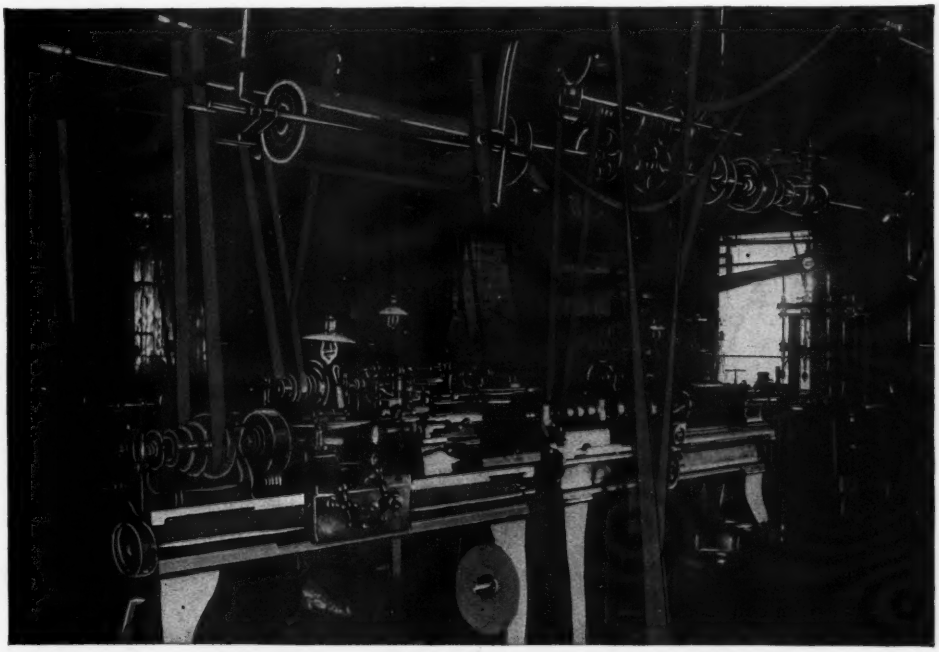


FIG. 3.—HEAVY LATHES IN THE STANDARD THERMOMETER AND ELECTRIC COMPANY'S FACTORY.

The lamps are first tested until they run at the required current consumption without covers; then they are cased up and run for several hours to develop any imperfection that may interfere with their good working after they leave the shop. The latest improvements in the construction of the lamps come from developments of the past few years' experience of the users of the lamps. They meet all the weak points that have been shown to exist, which as fast as discovered have been studied and overcome. The constant trying of new devices suggested for doing this is another testing-room job and more or less new lamps are always burning there.

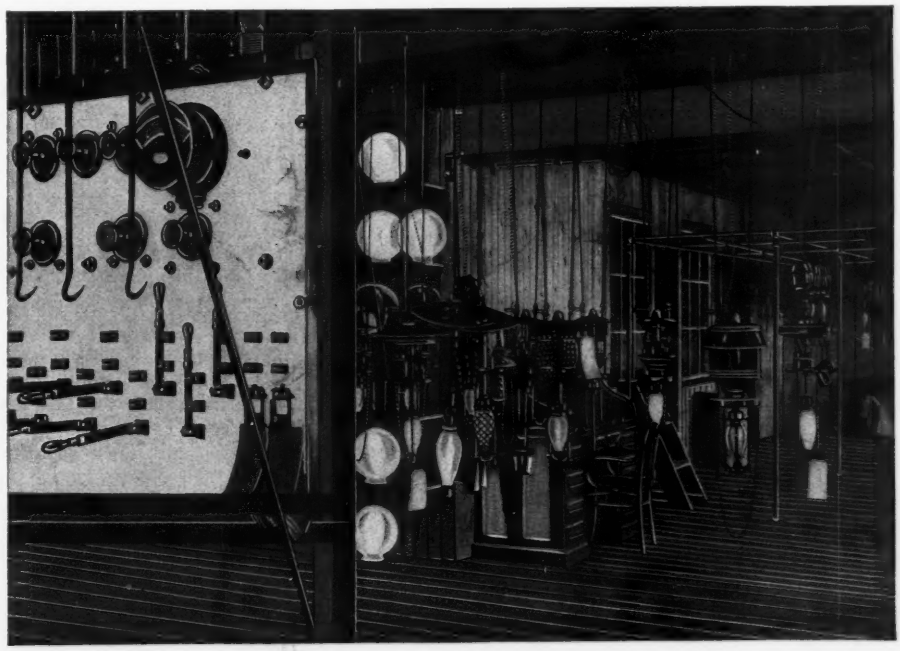


FIG. 4.—SWITCHBOARD IN THE LAMP TESTING-ROOM OF THE STANDARD THERMOMETER AND ELECTRIC COMPANY.

The original "Midget" lamp was at the time of first offering several inches shorter than any other lamp on the market burning a 12-inch carbon. This was done in it by putting the clutch directly on the carbon and doing away with the use of a carbon rod.

On the third floor in the annex are the testing-room and the setting-room for thermometers. In the former every thermometer made passes through the hands of an expert, who adjusts the length of the lamina so the thermometer hand will make the proper amount of movement when exposed to varying temperatures. In the setting-room the hands of the thermometers are set by comparison with numerous standardized thermometers, and they are finally adjusted.

On the top or fourth floor of the building the assembling of lamps and thermometers is done. The parts are sent to the room from the stock-room as needed, and they are put together rapidly and skillfully by the expert workmen there. On this floor the winding of magnets and solenoids is also done, the spoolers being driven by individual motors from the 110-volt lighting current, this method being adopted on account of the instantaneous speed control possible. The factory is served by two elevators, one for freight and a small one for sending stock to and fro throughout the factory.

The long experience in the manufacture of arc lamps by the Standard Thermometer and Electric Company has given them much information regarding the art that can not be had in the general run of shops. The generally accepted success of the old "Ward" lamp was due in no small measure to the skill used in its construction by the Standard Thermometer company, which built them all, as well as the Kinsman and Knight lamps. The makers of the Upton lamps can refer to the success of these lamps as a guarantee of the qualities of workmanship that can be expected in their products.

Electrical Review

OLDEST ELECTRICAL WEEKLY IN THE UNITED STATES.]

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An index to Volume XXXIII of the ELECTRICAL REVIEW is mailed to subscribers with this issue. Notice of failure to receive it should be sent to this office at once.

The central station business in Manhattan Borough is looking up. Hon. William C. Whitney is credited with an ambition to own all our electric lighting plants. If the report is true, Mr. Whitney will probably get them. He generally succeeds.

A French count is reported to have come over here and bought $5,000,000 worth of automobiles, $1,000,000 worth of which will be electric vehicles. We trust the count's money is as ready as the news is startling. Heretofore the French have prided themselves on their progress in the construction of self-propelled vehicles. They have an automobile club in Paris, too. The fact remains, however, that New York city is the only city in the world which supports a regularly maintained public automobile service worthy of the name, and that is electrical.

THE LATE R. T. M'DONALD'S CAREER.

The death at Dallas, Tex., of Mr. R. T. McDonald, on December 24, which was chronicled in the ELECTRICAL REVIEW last week, has been a topic of much discussion throughout electrical and financial circles. Mr. McDonald's interesting and vigorous career in connection with the electrical industry makes his personality a striking one.

His death of pneumonia was most sudden and unexpected. The disease made quick progress to such an alarming extent that his family physician was summoned from Fort Wayne, but death occurred the following day.

Many incidents of his career, which was one of great virility, are worthy of being recalled. In 1888 he came conspicuously before the people as an ardent supporter of Walter Q. Gresham for the presidential nomination against Gen. Benjamin Harrison. He was one of the leaders of the Gresham faction, and succeeded in organizing a large following. During the week of the national convention he ran a special train to Chicago, on which he carried a "tin bucket brigade," made up of employés of his Fort Wayne factories. For the past few years Mr. McDonald had rather withdrawn from politics.

The following incident, illustrative of his character, is mentioned. Late one afternoon, at the closing of a stockholders' meeting in New Orleans, he turned to a clerk and said: "What's the earliest train for Chicago?"

"The Chicago train is just leaving, sir, and the next departs in the morning, 12 hours later." Mr. McDonald turned and said to the clerk: "Kindly order a special train for Mr. R. T. McDonald, to be ready at the earliest moment. I can not spare 12 hours of my life."

At the time of his death Mr. McDonald was the owner of the Broad Ripple Electric Road at Fort Wayne, and during his career has been identified with a number of street railway interests, in addition to being the president and largest stockholder of the Fort Wayne Electric Corporation and prominent in the Fort Wayne Lamp Company, and other interests in New York and elsewhere.

WALL STREET AND THE ELECTRICAL STOCK MARKET.

Although the New York Stock Exchange was closed on Monday and Saturday of this week, enough business was done on the remaining four days to make up for the short week. On Tuesday the transactions were enormous, and surpassed those of any other day of the year. Prices were up, in some instances, to a record height. A slight reaction occurred on Wednesday, followed by a recovery Thursday, which held strong until the close of business on Friday.

After the great activity of the past few weeks, some good judges look for a period of liquidation or a decline. The controlling reason for such a change would be whether or not the recent large purchases of stocks and bonds have been made by investors for the income yielded, or by speculators for the immediate profits to be taken. If the former is the case, the market certainly will continue to rise. Conservative operators, however, look for a temporary break at any time.

On the New York exchange Edison Electric Illuminating closed the week at 194, within one point of the highest price reached during the short week. A report is current to-day that a syndicate, with Mr. William C. Whitney at its head, has secured control of this company, and that the syndicate will eventually absorb all the central station plants in the Borough of Manhattan. General Electric closed at 95¾, having reached 97 during the week. Both these prices are record figures for the stock. Western Union closed at 93¼, the high price for the week.

On the Boston exchange American Bell Telephone closed at 277 bid and 278 asked. On the Philadelphia exchange Electric Storage Battery common closed at 59 bid and 59½ asked.

Wall Street, December 31, 1898.

PERSONAL.

Prof. Alexander Graham Bell arrived in San Francisco last week on his return from a visit to China.

Professor Roentgen, of Würzburg, has declined the call to the University of Leipzig as the successor of Professor Wiedermann.

Prof. Eric Gerard, of the University of Liège, known for his contributions to electricity and magnetism, has been admitted to the Belgian order of Leopold.

Col. A. B. Chandler, of New York, president of the Postal Telegraph-Cable Company, has been elected a director of the Erie Telegraph and Telephone Company.

Hon. William Berri, of Brooklyn, N. Y., who has extensive interests in the electrical field, has returned from a two weeks' trip to Old Point Comfort. Mr. Berri believes that 1899 will be one of the greatest business years in the country's history.

Mr. A. E. Burland, superintendent of the Newport, R. I., Street Railway Company, received as a Christmas gift from his employés a handsome Morris chair and a complimentary address mentioning some of the many things he has done for the benefit of the employés and patrons of the road.

The handsome country house on Centre Island at Oyster Bay, L. I., owned by Mr. George Bullock, of the Bullock Electric Manufacturing Company, Cincinnati, Ohio, was destroyed by fire on December 30. The property was insured for about half its value. Mr. Bullock expects to rebuild at once.

Mr. Charles Wheeler, of Philadelphia, has given $5,000 to Harvard University in memory of his son, Stuart Wadsworth Wheeler, '98, who served in the Porto Rico campaign, and died in Boston a short time ago. The money will be invested, and the interest used as a loan fund in the Lawrence Scientific School.

Passed Assistant Engineer Walter M. McFarland, U. S. N., now on duty in Washington as an assistant to Engineer-in-Chief Melville, has resigned from the navy to accept a position with the Westinghouse Electric and Manufacturing Company, of Pittsburgh. It is understood that Mr. McFarland will become assistant general manager of the Westinghouse company. He is unusually popular in the naval service, and will undoubtedly be a welcome addition to the electrical field in which he already has numerous friends.

SCIENCE ABSTRACTS.

The following extracts of interest to our scientific readers are from the official publication of the Institution of Electrical Engineers, London, edited by Mr. J. Swinburne:

Adjustable Roentgen-Ray Tubes. A. A. C. Swinton—The several methods of making X-ray tubes adjustable, described in Abstract No. 1218, are discussed from the point of view of practical radiography. That in which the anode is fixed and the cathode is movable in and out of a glass annex is preferred, as with it the point of origin of the rays is constant, while a travel of one-half inch is sufficient to alter the penetration from the highest to the lowest value, so that definition is not interfered with. Cathodes should be well polished and accurately curved. They should not be too small, or they become overheated; nor very large, as in that case only the central portion is active. The platinum anti-cathode is best mounted on a massive block of aluminum to absorb the heat and prevent deformation and blackening. Blackening increases the resistance, not only by occluding the residual gas, but also by forming a non-fluorescent coating on the glass. The quantity of X rays and their penetrative value are distinct. The latter depends largely upon the potential difference, but is independent of the material used for the anti-cathode. The quantity is, however, greatest with anti-cathodes of the highest atomic weight.

Measurement of Hertzian Oscillations. A. Ekström—When an electric oscillation is propagated along a wire reflections take place at each end of the wire, and the interference curve obtained by taking electrometer or bolometer measurements at each point on the wire is usually a complex one. The author shows that, if the wire be a long one, the interference curve at a great distance from the oscillator has the same form as the primary oscillation. With shorter wires of variable length the form of the interference curve depends on the length, and contains harmonic overtones in addition to the fundamental oscillation. Four types of interference curve are given, to one or other of which the curves found by different physicists belong.

Phosphorescence of Rarefied Gases. H. F. Newall—Previous experiments on electric discharges in rarefied gases by Morrem, Sarasin and J. J. Thomson indicate that phosphorescence after cessation of the discharge only occurs in mixtures of gases, or simple gases which polymerize. The author's attention was drawn to the subject by observing brilliant phosphorescence in mixtures of oxygen with other gases when rendered luminous by electrodeless discharges. He finds that in all cases the spectrum of the phosphorescent glow is a continuous one, even when the pressure of the gas is only 0.1 millimeter mercury; in no case have lines or bands been observed. On concentrating a beam of sunlight upon the phosphorescent gas no scattering of polarized light is observed, so that there is no evidence of the presence of solid particles in the gas. Black or brown deposits appear occasionally on the inside of the (electrodeless) glass tube; sometimes they form a thick film, and they indicate that chemical changes are produced by the discharge. The author connects white phosphorescence with mixtures of oxygen and carbon, yellow with oxygen and nitrogen, and blue with oxygen and sulphur. The afterglow appears at pressures between 0.01 and 0.6 millimeter, and is greatest at about 0.4 millimeter, the limits varying slightly for different gases. By altering the pressure during phosphorescence increased brightness may be produced. When a mixture of gases is first compressed the operation renders it luminous; but if it be then rarefied and recompressed, it does not again glow, unless it be put in communication, while rarefied, with a bulb in which an electrodeless discharge is taking place. The author considers that the gaseous molecules form themselves into groups at low pressures, which are destroyed as the pressure is increased, and he describes phenomena supporting this view. The spectrum of the pressure-glow differs from that following electrical discharge, the pressure-glow containing four bright oxygen bands. The luminosity of condensing nebulæ may be due to pressure-glow; in the center of the nebula the pressure is too great, and on the edge too small, for visible phosphorescence. The luminosity of the intermediate layer will be persistent on account of the streaming in of rarefied gas, and will not point to a high temperature of the nebula.

Telephone President Indicted.

The Grand Jury, on December 31, returned a true bill against Col. Samuel M. Bryan, president of the Chesapeake & Potomac Telephone Company, on the charge of violating the act fixing the yearly rental of the telephones in the District of Columbia. The law, which was enacted last June, fixed the yearly charges at from $50 to $25, according to the number of telephones on a circuit. The company contended that the act was unconstitutional and adhered to the former rates. A number of injunctions have been obtained to prevent the removal of telephones upon tender by subscribers of the amount fixed by the act. These injunctions will soon be heard before the District Court on the constitutionality of the act in question. Mr. Bryan stated to a REVIEW representative on Monday that the matter was in the hands of his attorneys.

AN ELECTRICAL MAN ON GOVERNOR ROOSEVELT'S STAFF.

S. DANA GREENE WILL REPRESENT THE NAVAL MILITIA IN THE GOVERNOR'S MILITARY FAMILY.

Lieutenant-Commander S. Dana Greene, of the New York Naval Militia, has been detailed for duty as an aide on Governor Roosevelt's staff, beginning January 1. The detail was made in general orders at the request of the Governor.

Mr. Greene is well known in the electrical field, and for some years has been the general manager of the lighting department of the General Electric Company. He was graduated from the Naval Academy at Annapolis

LIEUT.-COMMANDER S. DANA GREENE, NEW YORK NAVAL MILITIA.

in 1883, and received his commission as ensign in 1885. He resigned from the service in 1888 to enter the electrical field with which he has since been actively connected. For a time he was chief engineer for the Sprague Electric Railway and Motor Company, and since then has been identified with the General Electric interests.

In common with other naval officers he has always maintained his interest in naval affairs, and joined the New York Naval Militia when it was organized in 1891. He was chief of staff of the First Battalion when war with Spain was declared, and was ordered with other officers to the auxiliary cruiser "Yankee," on which he served throughout the campaign as a lieutenant (junior grade). Upon being discharged from the United States service he was reappointed lieutenant-commander and chief of staff to Capt. J. W. Miller, the commanding officer of the New York Naval Militia.

Mr. Greene is a son of the late Commander S. Dana Greene, who was second in command of the "Monitor" when she fought the "Merrimac," and in full command during the greater part of the battle owing to the disablement of Captain Worden shortly after the fight commenced. His grandfather, Gen. Geo. S. Greene, is the oldest living graduate of West Point, and his uncle, Maj.-Gen. Francis Vinton Greene, U. S. V., has recently returned from service with the army in the Philippines.

American Institute of Electrical Engineers.

At the 129th meeting of the institute, held on Wednesday evening, December 28, Mr. Arthur A. Hamerschlag delivered a lecture on "Education of Electrical Apprentices and Journeymen," illustrated with lantern slides.

At a meeting of the executive committee in the afternoon the following associate members were elected: John Allan, full partner, H. H. Kingsbury & Company, 54 Margaret street, Sydney, N. S. W.; John Jacob Bellman, electrical engineer, Crocker-Wheeler Electric Company, residence, 90 King street, New York; Robinson Crowell, electrical tester, General Electric Company, residence, 72 Washington avenue, Schenectady, N. Y.; Henry B. Dates, professor of electrical engineering and physics, Clarkson School of Technology, Potsdam, N. Y.; John C. Finney, cashier, Wisconsin Trust Company, residence, 34 Prospect avenue, Milwaukee, Wis.; William N. Gladson, professor of electrical engineering, Arkansas Industrial University, Fayetteville, Ark.; Leo Walter Hildburgh, student, Columbia University, residence, 1 West Thirtieth street, New York; William B. Hodge, electrical engineer, Elmer G. Willyoung & Company, residence, 707 Spruce street, Philadelphia, Pa.; Saitaro Oi, chief engineer to the bureau of telegraphs, The Ministry of Communications, 16 Kamitomisakacho, Koishikawa, Tokyo, Japan; Francis E. Tyng, manager, Eastern Engineering Company, New York, residence, Cranford, N. J.; Arthur J. Wood, associate editor, *Railroad Gazette*, 32 Park place, New York, residence, 162 Washington Park, Brooklyn, N. Y.

A Large Order for Electric Vehicles.

A press dispatch from Chicago last week stated that the Fisher Equipment Company, of Chicago, had contracted to furnish $1,000,000 worth of electric vehicles, to be sold in Europe during the next 10 years. Count de Jotemps, of Paris, who is interested in the development of automobiles, is said to have placed the order. He is also reported to have bought a large number of gasoline and steam automobiles. The first shipment of electric vehicles will be made from Chicago, it is said, during the current month.

ELECTRIC LIGHT FLASHES.

The Queens Borough Electric Light and Power Company have filed plans for a new plant at Far Rockaway, to cost $30,000.

The Boston Electric Light Company has declared its regular quarterly dividend of $1.50 per share, payable January 14. Books closed December 31 and reopen January 15.

The People's Electric Light and Power Company, which supplies light for Yardley and Morrisville, Pa., announces that the price of service will advance nearly one-half after January 1.

The Kings County Electric Light and Power Company has ordered two 3,000-kilowatt generators from the Westinghouse Electric and Manufacturing Company. They will cost between $80,000 and $85,000.

The earnings for November of the Edison Electric Illuminating Company, of New York, were as follows:

	1898.	1897.	Increase.
Gross.....	$286,941.21	$247,295.44	$39,645.77
Net	124,873.96	120,568.20	4,305 76
Gross, 11 months....	2,711,602.62	2,205,630.56	505,972.06
Net 11 months	1,134,059.81	977,822.08	156,237.73

The plant of the Council Bluffs, Iowa, Gas and Electric Light Company has been sold by an official of the Federal Court to satisfy a mortgage of $250,000 held by the Farmers' Loan and Trust Company, of New York.

At the meeting of the directors of the Winchendon, Mass., Electric Light and Power Company the following officers were elected: President, Morton E. Converse; superintendent, Frank W. Nourse; clerk of the board of directors, Franklin A. Park.

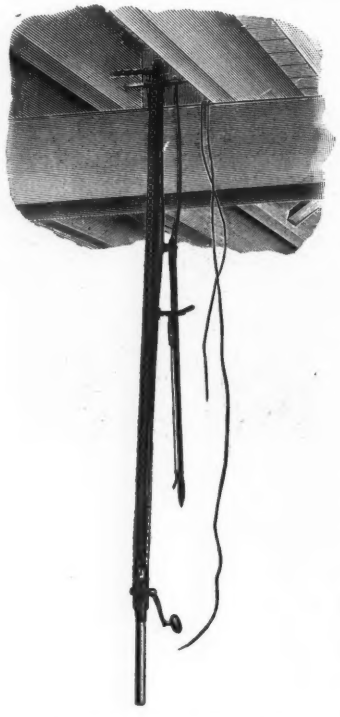
The following directors of the Hollidaysburg, Pa., Electric Light and Power Company were elected at the annual meeting held a few days ago: Maj. O. M. Irvine, James W. Gromiller, John W. Goodfellow, J. Lee Plummer, Esq., and W. H. Markland.

The Buffalo, N. Y., General Electric Company will refund and exchange its present bonded indebtedness of $2,100,000 in six per cent bonds, with a call redemption proviso for a like amount of five per cent 40-year gold bonds, with no prior redemption clause.

Charles R. Huntley, on behalf of the Cataract Power and Conduit Company and the Buffalo General Electric Company, of Buffalo, N. Y., has closed negotiations for a big new storage battery to be placed in the station on Wilkeson street. The battery will handle 20,000 lights for two hours.

The Queens Borough Electric Light and Power Company has filed plans for a new plant at Far Rockaway, Long Island, N. Y., to cost $30,000. D. H. Valentine is president of the company, and it is said that former Lieut. Gov. John C. Sheehan and John Carroll, of Manhattan, are stockholders.

The Salem, Mass., Aldermen have adopted the report of the electric lighting committee for a three-years' contract for 180 arc lights at $135 each, and 520 incandescents at $23. The total cost will be $36,260 for lights, or $3,288 a year less than heretofore. The committee was directed



A NEW BORING DEVICE.

to make a contract in accordance with the report and submit it to the City Council.

To construct the water-power dam at Helena, Mont., over 200 men were employed for over two years, and the amount of granite, timber and earth used was something enormous. The electric power developed is something over 30,000 horse-power, and the uses to which it is being applied are many. Chief among them are the East Helena smelters and concentrators, all of the mining power, street car, light and newspaper plants in Helena, telegraph and telephone systems, factories and for cooking.

A $25,000,000 electric-lighting corporation is being organized by the Dolan–Widener–Elkins combination. The company will control the entire eastern part of Pennsylvania, and probably Delaware. The capital stock will be divided into 500,000 shares, 300,000 of which will be issued and 200,000 left in the treasury for future use. Of the 300,000 shares to be issued, 100,000 will go to stockholders of the Pennsylvania Manufacturing Electric Light Company. The president of the new company will be W. J. Latta, of the Pennsylvania Railroad. In addition to the capital stock a bond issue of $10,000,000 is expected.

The St. Anthony Falls Water-Power Company, of Minneapolis, Minn., has closed a contract with the General Electric Company for completing the equipment of its power-house at the lower dam with electrical machinery. When the power-house was finished about a year ago, the electrical equipment was furnished for 7,000 horse-power out of a total of 10,000 horse-power capacity. This equipment has been in successful operation for about a year, and, up to the present time, three out of the proposed 10 sets of water-wheels, with the corresponding electrical equipment, have been left uncompleted. By the contract just closed, three additional sets of water-wheels are to be placed in the power-house, together with the complete electrical equipment necessary; and when this equipment is placed, the power plant, as originally proposed, will be complete. The new contract involves an expenditure of something like $100,000, and the new equipment will probably be placed and ready for use by July 1. The new power will be used for street railway purposes, and for general use by manufacturing plants throughout the city.

A New Boring Device.

The Gaylord & Eitapenc Electric Company, of Binghamton, N. Y., are manufacturing a new boring machine for the electric constructor, which has the best qualities of a number of devices embodied in it. The machine is said to be a wonderful labor and time saver over the common hand brace or any other similar tool in the market. The holes are actually bored laterally through the joists, and can be bored with ease in a true line. It, therefore saves wire, the insulation, kinks, copper and hard words. No stepladder is required, any one can use it. It bores very easily. Messrs. Gaylord & Eitapenc have just fitted up, at a great deal of expense, special machinery to turn out these machines fast enough to supply the ever-increasing demand.

Bequests to the Massachusetts Institute of Technology.

The past year has been a remarkable one in the financial history of the Massachusetts Institute of Technology at Boston. More money has been received through bequests and gifts than in any previous year. Under the will of the late Hon. Henry L. Pierce $750,000 has been paid to the institute by his executors. This is the largest sum ever given to it by any one giver. In addition to this the executors of the late Mrs. Julia B. H. James have paid over the very notable sum of $140,500, this being also one of the largest gifts ever made to the institute.

Mr. George A. Gardner has generously given $20,000 as a fund, the income from which is to be used in the payment of salaries—a much needed provision. Ten thousand dollars has come from the late John W. Carter, and $1,482.79 has been added to the large sum previously received from the estate of the late Mrs. Susan E. Dorr for the Rogers Physical Laboratory.

Beside these gifts to the institute itself, a traveling fellowship in the architectural department has been established by the will of Willard B. Perkins, M. I. T., '72. For this purpose the sum of $6,000 has been given, the accumulated income from which is to be used every fourth year.

Forty thousand dollars has come from the estate of the late Mrs. Ann White Dickinson, the whole sum for scholarship purposes. A friend has given $500 to meet a special want, and $200 has come from Mrs. William B. Rogers, to be used for periodicals.

This great increase in funds came at a time when it was very much needed. It at once led to the erection of the new fireproof building in Trinity place, which is to bear the name of the late Hon. Henry L. Pierce. It has also made possible extensive changes and improvements in the old buildings.

It is expected that the institute will receive $400,000 from the estate of the late Edward Austin. This amount appears to be intended for scholarships and other similar uses and will be highly appreciated, but the great desideratum for the immediate future is accessions to the unrestricted funds of the institute.

The Cambridge, Ill., Telephone Company, capital $960, has been incorporated by J. A. Kirkland, G. A. Weaver and James Pollock.

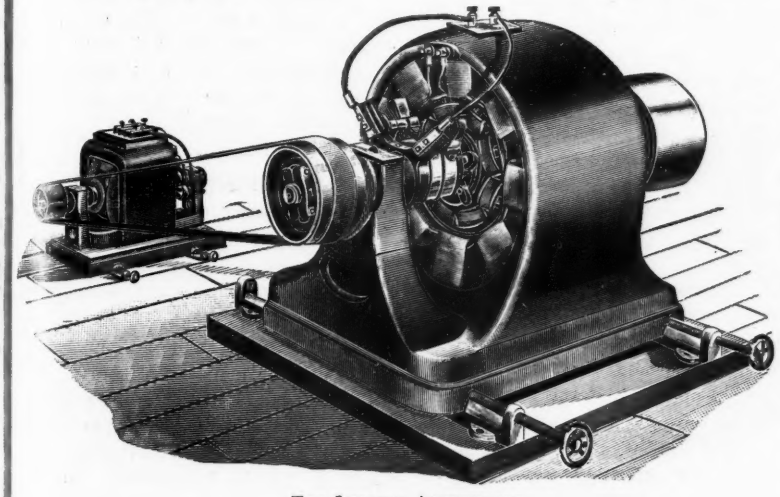
The Lincoln Alternator.

A great amount of care has been taken by the Lincoln Electric Company, of 71 Ontario street, Cleveland, Ohio, in the construction of their new 300-light alternating dynamos, in order to make a high-power long-lasting machine.

The armature teeth and pole-pieces are so arranged that the dynamo runs very quietly, making less noise than a direct-current one.

This absence of noise shows the design to be almost perfect, and that there are no irritating or heat producing losses while the machine is in action.

The dynamos are made in generous proportions, and with plenty of material for the work they have to do.



THE LINCOLN ALTERNATOR.

The pole-pieces and main frame are cast in one piece, and bored out.

The boxes are bolted to the standards, thus insuring perfect alignment and absolute rigidity, while the bearings are made of bronze, self-oiling and large in diameter.

The armature and field coils are well ventilated, and the load may be increased or diminished without changing voltage.

When regulation is needed it is accomplished by changing the resistance in the shunt fields of the exciter, a method that involves the least possible waste.

The machines are built for 7,200 alternations per second, but may be increased higher, the machines being built with a large factor of mechanical safety.

The Mexican Telephone Company has declared a quarterly dividend of two and one-half per cent, payable January 13. Books closed December 31; open January 14.

Northwestern Electrical Association.

The transportation committee, consisting of Messrs. W. W. Low, James Wolff and Geo. S. Whyte, of the Northwestern Electrical Association, has issued the following notice:

The association will hold its business meeting for the year at Milwaukee, Wis., January 18, 19 and 20, 1899; headquarters at the Pfister Hotel, where very satisfactory arrangements have been made.

The Transportation Committee are pleased to advise that they have secured favorable ratio of fare and one-third for the round trip (on the certificate plan) from points in the northern peninsula of Michigan, Wisconsin, Illinois, Iowa and Minnesota, via the Chicago & Northwestern Railway, and have arranged for special parlor cars to be attached to the 8.30 A. M. train, leaving the passenger station, Wells and Kinzie streets, January 18, 1899.

To enable us to properly provide for the comfort of members, it is hoped that all those who expect to attend this meeting will notify us at once, that ample accommodations may be provided.

The officers of the association have made every effort to make this meeting one to be remembered. Several very important and interesting papers, to those running central stations, will be read. It is hoped all members, who either start from or pass through Chicago, will join the Chicago delegation.

All members should purchase regular one-way tickets, taking receipt therefor, which, when properly signed by the secretary and railway agent at Milwaukee, will entitle them to the one-third fare returning.

The People's telephone line at Lodi, Ohio, has been sold to the Ashland Home company, a company composed of 12 Ashland business men. The consideration named was $30,000.

ELECTRIC RAILWAY NOTES.

An electric railway from Saginaw to Detroit, Mich., is said to be contemplated by a number of Detroit and eastern capitalists. Work will begin in the Spring. The Saginaw & Frankenmuth Railway is securing a right of way, and construction will soon begin.

The Buffalo, N. Y., Tonawanda & Niagara Falls Electric Railway Company has entered into a contract with the Cataract Power Company, of Niagara Falls, for the use of sufficient power to enable it to operate its line. The contract is for a period of five years, and the price is said to be about $29 for each horse-power.

Negotiations between the Northwestern Elevated Railroad Company, of Chicago, and Blair & Company, of New York, were concluded last week for a loan of $4,500,000, and the last obstacle removed thereby from the path of the projectors of the intramural railroad for which the residents of the north and northwest sides of the the city have been waiting for the last two years. Active work will be begun at once on the completion of the railroad.

Dr. J. E. Lowes, a Dayton, Ohio, capitalist, has made a proposition to that city for the construction of an electric line from Eaton, Ohio, to connect with the Dayton & Western Traction Company. He asks a $50,000 stock subscription, free right of way and a favorable franchise. He also asks a $10,000 stock subscription of New Paris, Ohio, and a $5,000 stock subscription of those living along the route. The estimated cost of the road is $270,000.

The San Juan & Rio Piedras Railroad Company, with a capital of $300,000, has been incorporated under New York state laws. It proposes to construct and operate an electric or steam railroad seven and one-half miles long, from San Juan to Rio Piedras, Porto Rico. The directors are George H. Walbridge, Fernando G. Echeverria, H. H. Harrison, Edward Schmidt, Lathrop R. Bacon, F. Kingsbury Curtis, Philip H. McMillan, Augustus N. Hand and William B. Parsons, of New York city.

At the annual meeting of the Albany, Helderberg & Schoharie Electric Railway Company the following officers were elected: President, H. W. Burgett, of Brookline, Mass.; vice president, B. M. Secor, Albany; secretary, William H. Irwin, Albany; treasurer, Charles E. Bibben, Boston; finance committee, President Burgett, Vice-president Secor, E. W. Twitchell, Schoharie; Robert McCauley, Albany, and Treasurer Bibben. The stockholders elected the following board of directors: H. W. Burgett, B. M. Secor, R. J. McCauley, Thomas J. Wood, Berne; E. W. Twitchell, Schoharie; H. W. Smith, Boston; W. H. Irwin, James M. Borthwick, Albany; Charles H. Brown, Boston; O. F. Plank, Gallupville; Rufus H. Sawyer, O. L. Brown, Boston. Inspectors of election, William L. M. Phelps, William G. Jones and John J. Bradt.

Senator William Johnson, receiver of the Union Traction Company, has been ordered by the Court of Chancery to sell the roadbed, cars, fixtures, buildings and everything else belonging to that company in Hudson and Bergen counties, N. J. The railroad is in operation from North Arlington to Woodbridge, a distance of eight miles. The company had secured a right of way as far north as Hackensack, but owing to the demand of that town for $50,000 for right of way, which the company could not pay, it went into a receiver's hands. It was admitted that if the right of way had been obtained the company would have been able to float $1,000,000 worth of bonds and complete its lines. The Metropolitan Trust Company is the complainant in the foreclosure suit. It is understood that at least four competitors will bid at the sale on January 27.

Long Spans of Telephone Wire.

TO THE EDITOR OF ELECTRICAL REVIEW:

We notice in your issue of December 21, under head of "Telephone News and Comment," an article with reference to a single span of wire 1,600 feet in length, in which it is claimed that it is the longest single span of wire in Pennsylvania and possibly in the United States.

We have four river crossings in the state of Arkansas, any of which will exceed the above-mentioned span; our longest span being across the Arkansas River seven miles east of Pine Bluff. This span is 2,000 feet in length and is supported by two steel towers, 100 feet in height. This is undoubtedly one of the most expensive river crossings, as well as one of the finest pieces of construction in the United States.

The other crossings are located at Van Buren, Fort Smith and Dardenelle. Yours very truly,

F. L. POWELL,
General Superintendent Southwestern Telegraph and Telephone Company.
Little Rock, Ark., December 24.

OUR CHICAGO LETTER.

Edmund Furthmann, for the past 11 years attorney for the North Chicago Street Railway Company, has sent in his resignation to take effect January 1. Mr. Furthmann has an extensive practice, and has taken this step so he can devote his entire time to his private practice. Previous to his connection with the railway company Mr. Furthmann was state attorney under Julius Grinnell.

Mayor Harrison has taken in hand the matter of a possible renewal of the ordinance of the Northwestern Elevated Railroad. The present ordinance expires January 1, and before a new one is granted the city will require a good bond as surety that the road will be completed within a specified period of time, the limit of which can be determined. The present bonds now held by the city are deemed insufficient.

A Chicago traction company has asked the board of commissioners of Lebanon, Ind., for a franchise to construct an electric trolley line from Indianapolis through some of the smaller towns to Lafayette and Logansport, and eventually reach Chicago. The object of the line will be to touch the gas belt from both cities.

The outlook for a prosperous year for '99 in the business world is especially bright. All classes of trade are already benefited, and the merchant and manufacturer will cheerfully testify to this fact. Just at this particular season of the year, trade in the more staple lines is, of course, more brisk than at other times, owing to the exhilarating influences of the holidays. The railroads, the mails, the express companies and the crowded streets of Chicago supply enough evidence to the doubtful that we are now entering into a prosperous period, and that hard times are a thing of the past. Passenger representatives of all the steam railroad lines entering the city say that never before have the railroads enjoyed such a heavy holiday passenger traffic as at the present time.

The trolley and cable lines are crowded from morning until night, and using all the extra cars they have. The elevated railroads are also doing a very heavy business. This year, more than ever, electric lighting has played a most prominent part in the holiday display in the windows of nearly all the downtown stores, and manufacturers of window reflectors and incandescent lamps have profited thereby. Hundreds of lamps are used for decorative sign purposes and to ornament the exterior of buildings. There has been a brisk demand for miniature lamps for this class of work. At night State street presents to the resident and visiting shoppers a bewildering display of electric light.

Local manufacturers of electrical supplies report a large trade and, in many instances, factories working day and night to keep up with orders on hand. In the telephone field the leading manufacturers who have been interviewed say they are very busy, and several of the leading concerns say they have enough business booked to run their factories for some months. All these points indicate a feeling on the part of the manufacturers and others that good times are surely returning.

The Central Electric Company are enjoying an excellent business, part of which is due to the untiring energy and close application to business of Chas. E. Brown, secretary and general manager of the company. Mr. Brown has hosts of friends, and the Central Electric Company are fortunate to have such a good business man with them. Mr. F. M. Pierce, manager of the house goods department, is a very busy man these days; having all he can attend to to supply the increasing demand in telephone outfits and general electrical supplies. Mr. Pierce is a courteous, affable gentleman, and his long connection with the house has aided very materially in building up the Central Electric Company's excellent business.

The American Electric Telephone Company have been exceedingly busy lately and are trying to catch up with the orders in hand. In addition to the manufacture of other telephone apparatus the capacity of the factory is 125 switchboard drops per day. They already have orders for 3,600 in advance and are working until 11 o'clock each night. These facts are excellent recommendations of the high class apparatus put into the market by this company. F. E. C.

Chicago, December 30, 1898.

The Central Union Telephone Company has closed a deal whereby the plant at Noblesville, Ind., which was built and operated by an independent company, has passed under its control. The Central Union had no exchange or franchise in Noblesville, and it at once took possession of the plant, and the lines are now open for business. With the exchange are transferred 130 subscribers and all rights under the franchise. It is reported that another independent telephone company has been organized at Noblesville.

A "Wagner" Transformer Installation at Niagara.

It is announced that the Wagner Electric Manufacturing Company, of St. Louis, through the manager of sales, Mr. E. H. Abadie, has secured what is said to be the largest transformer order yet placed in this country. The installation is for the Union Carbide Company for its carbide works at Niagara Falls, N. Y., to be used in connection with electricity generated by water-power.

The equipment will consist of seven static transformers of 2,000-horse-power output capacity each, two static transformers of 500-horse-power output each, with a completely constructed switchboard. These transformers are to be of the oil-filled type, with water coils for lowering the temperature of the oil.

It is mentioned that the contract was arranged on definite specifications as to iron and copper losses, full, three-quarters, one-half, one-quarter and one-tenth load efficiency, guaranteed as to temperature rise, also as to insulation testing, and guarantees made as to 50 per cent overload in current.

An interesting fact relative to this electrical machinery is that the installation, though to be possessed by the Union Carbide Company, is subject to the approval of the great Niagara Falls Power Company.

The fact that the Wagner company have been given the construction of these large transmission transformers under these conditions, will give the products of their shops an added endorsement.

This company also now have 40,000-volt high-tension transformers in operation at Provo, Utah, and Telluride, Colo., and are preparing other transformer installations for high-potential transmissions, where the units range from 100 to 500 horse-power, and the high-tension voltage as high as 40,000 volts.

A Misfit Assignment for a Naval Engineer.

A well known chief engineer of the navy, who doesn't have to take any dust from General Shafter in the matter of avoirdupois, tipping the scales, as he does, at a trifle more than 300 pounds, was recently ordered to take charge of the mechanical department of one of the smaller gunboats on the Pacific station. The engineer didn't particularly like the assignment, but it didn't worry him to the point of suicide. He simply sat down and made a sketch of the exceedingly narrow doors that led into the engine-room of the gunboat to which he was ordered, marking the dimensions of the doors in figures on the sketch. Below his drawing of one of the engine-room doors this jolly chief engineer made a neat sketch of himself, full figure, not exaggerating his Falstaffian paunch a trifle. He attached his own dimensions in feet and inches, circumferentially, to this sketch of himself. Then he put the sketches in an envelope and "respectfully submitted" them to the Bureau of Navigation. It was a sort of document that occasionally makes a hit. The inference to be drawn from the sketches was so obvious—the impossibility of the chief engineer's passage through the engine-room doors of the ship to which he was ordered was so apparent—that the assignment was recalled, and the laconic chief engineer is liable to get a flagship when the next batch of steam engineering assignments is made.—*Washington Post.*

Growth of Electric Lighting in Hamburg, Germany.

The central station at Hamburg, Germany, shows a remarkable growth since its establishment five years ago, according to an exchange. In April, 1894, the lamps and motors connected to the mains were equivalent to 27,000 lamps of 16 candle-power. At the end of June, 1898, the connections had increased to the equivalent of 163,277 lamps, made up as follows: 107,324 incandescent lamps and 2,636 arc lamps, taking 904,250 watts; 759 motors, of 2,313 horse-power. If all motors and lamps were on at the same time, the load would be about 8,160 kilowatts. The net work of mains comprises some 560 miles of lighting and 75 miles of traction cable.

Electrical Apparatus in Bridge Building.

It is reported that a bridge of 900-foot span at Budapest is being erected entirely by means of electrical machinery. The iron girders used as piles to keep the water back from the excavations for the shore pillars were driven in by an electric ram. The ram was a hammer rising 34 feet, with a velocity of 12 feet per second. The soil out of the holes was raised by an electric windlass. The water was removed by seven centrifugal pumps working day and night. The five-inch diameter pumps were driven by 10-horse-power motors, the eight-inch by a 16-horse-power, and one nine-inch by a 20-horse-power motor.

The Dicke Ball-Bearing Pay-Out Reel.

The reel illustrated herewith is the only one of its kind manufactured. The novel and valuable feature is the method of supporting the circular platform upon which the wire is placed. In the accompanying illustration, two of the cross-arms of the reel are cut away so as to give a good view of the truncated cone, on top of which can be seen a number of small balls. The reel revolves upon these balls, reducing the friction to a minimum. In practical work the friction is inappreciable, and whether the load be heavy or light, there seems to be no increase necessary in the effort to operate the reel.

THE DICKE BALL-BEARING PAY-OUT REEL.

The reel is manufactured of the best white oak, is strongly mortised, ironed and bolted. The balls and bearings are made of tempered steel and will stand much use. The Western Electric Company, of New York and Chicago, are the exclusive agents for the sale of this reel in the United States.

The Zeco Arc Lamp.

In the accompanying illustrations are shown several types of the Zeco arc lamps, placed on the market by the Central Electric Company, of Chicago. The experts of this company have devoted a great deal of time and work to figuring out the various details of the lamp, so as to insure perfection and permanency of operation. All of the exposed parts are nickel-plated, and the coils are wound with a special water and fireproof wire.

FIG. 1.—TYPE A, ZECO ARC LAMP.

FIG. 3.—TYPE D, ZECO ARC LAMP.

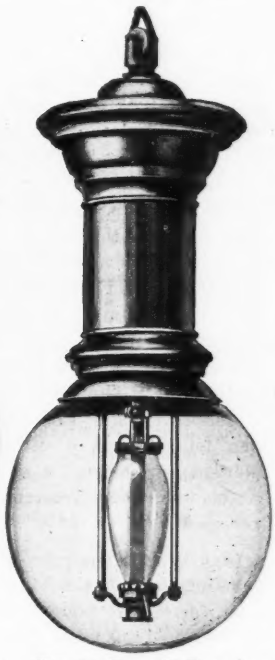


FIG. 2.—TYPE B, ZECO ARC LAMP.

The clutch is a special feature of the lamp and is adjustable to any size carbon or to any irregularity. No carbon rod is employed, the current being conducted direct to the carbon by eight brush contacts of bronze. On the direct-current lamp is a simple adjustment in the resistance to take up any variation in voltage, and further adjustment is accomplished by three loops cutting out sections of the solenoid winding. The lamp may be regulated to pass from three to six amperes, as desired, giving proportionate candle-power. The same simplicity has been carried out in the design of the alternating-current lamp. By a peculiar construction of the reactance coil, the hitherto objectionable features of undue heat and noise are claimed to have been entirely eliminated.

The alternating lamp is designed for operation direct upon a secondary circuit from 100 to 125 volts. It will burn for about 80 hours with one pair of carbons requiring four and one-half amperes and 75 volts at the arc. The lamp may be used on circuits of either 7,200 or 16,000 alternations per minute. The direct-current lamp is furnished for use on circuits of 110 to 120 and 220 to 240 volts.

FIG. 4.—TYPE C, ZECO ARC LAMP.

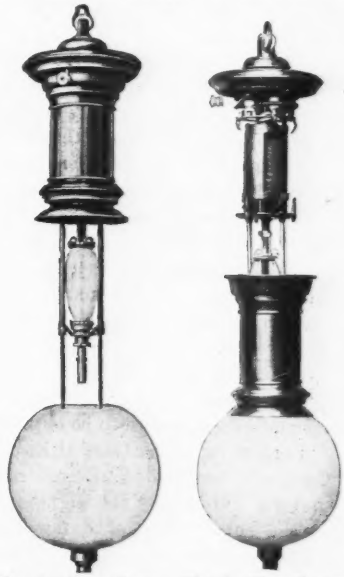


FIG. 5.—ZECO LAMP WITH GLOBE LOWERED.

FIG. 6.—ZECO LAMP WITH GLOBE AND CASING LOWERED.

INDUSTRIAL NOTES.

The John A. Roebling's Sons Company, 117 Liberty street, New York city, is sending to its customers and friends a neat stamp case of leather.

The American Electrical Works, of Providence, R. I., have sent to their numerous customers and friends a very handsome steel engraved calendar carrying a portrait of Professor Morse.

Mr. C. F. Stillwell, manager of the well known "Edison, Jr.," Incandescent Lamp Company, announces a large number of export orders during the last month. By means of various tests applied, the efficiency and durability of the lamp is becoming very favorably known abroad. An order for 10,000 of the lamps was shipped last week to India.

The Electric Appliance Company, Chicago, have for distribution to the telephone trade a sample card of such of their celebrated Paranite wires as are particularly adapted to telephone uses. The card shows samples of No. 19 plain and braided single conductor Paranite of a high insulation, suitable for telephone work. It also shows samples of No. 19 duplex twisted Paranite wire in three styles, the first being plain with one conductor of red rubber, and the other with black rubber insulation; another sample

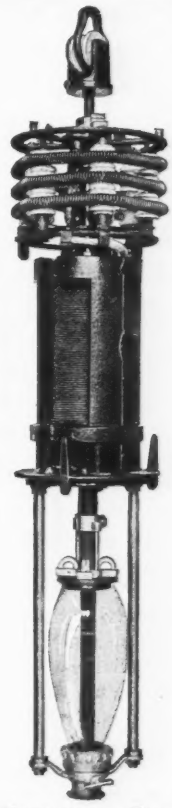


FIG. 7.—MECHANISM OF ZECO DIRECT-CURRENT ARC LAMP.

with black and red rubber insulation, but braided over with a regular saturated weatherproof braid. There is still another sample of the No. 19 two-conductor twisted, having red and black rubber insulation, but having glazed braid instead of the saturated braid. These sample cards can be had for the asking.

A Pamphlet on Transformer Design and Operation.

Under the title "Transformer Design and Operation" the General Electric Company issues in pamphlet form two important papers on the subject of electrical transformers. One is written from the standpoint of the central station manager by Mr. W. F. White, general manager of the Omaha, Neb., Electric Light, Heat and Power Company; the other by Prof. Winder Elwell Goldsborough, M. E, deals intimately with the question of transformer economy. The first paper, which was read before the American Institute of Electrical Engineers, is the record of long personal experience with the operation of transformers under actual commercial conditions, showing the relation of the many losses incident to the use of many small transformers, to the earning capacity of the plant, and the very tangible economies realized as the result of the substitution of a few high-efficiency transformers of large capacity. Mr. White gives examples of these economies reduced to dollars and cents. In his station a saving of $6,000 per annum in the cost of coal alone was realized as the result of the practical application of lessons drawn from his extended observation and experience.

Professor Goldsborough's paper was read before the National Electric Light Association and treats of the inherent economy of transformers of various design and construction. It contains many able arguments in favor of the use of high-grade transformers and emphasizes the necessity of frequent tests as the only means of detecting leaks, losses and the general depreciation of transformers. Professor Goldsborough gives examples of manufacturers' claims belied by careful test, but instances other cases in which guarantees have been exceeded, and urges upon station managers the wisdom of keeping as vigilant a watch on the efficiency of their transforming apparatus as upon the items of operating expense and maintenance if economical results are to be obtained.

To these papers the General Electric Company has added several maps showing graphically the significance of the substitution of a few large transformers for numerous small ones. The pamphlet is, as usual, well printed and illustrated, and should find a prominent place in the literature of every alternating-current station and every educational institution. It will be sent free by the General Electric Company.

Central Electric Company's New Catalogue.

The new general catalogue of electrical supplies for 1899 issued by the Central Electric Company, of Chicago, is an attractive volume of 537 pages, handsomely bound in cloth.

The material catalogued which, by the way, is thoroughly illustrated, is modern and up to date. The items evidence a careful selection, and the company states that, from its point of view, it is the best obtainable of the various kinds described.

The catalogue includes every possible requisite for electrical construction in any of its established branches. Among other things carefully listed are the "Zeco" enclosed arc lamps, which are now enjoying a very large sale. The clutch in these lamps is a special feature, which has been favorably passed upon by numerous experts. As a whole the catalogue leaves nothing to be desired, and it is a volume which should be in the hands of every electrical man.

Lightning in a Mine.

A French authority is quoted by a mining paper for the following: At the Abhooz Colliery, near Haveny, on July 1, 1897, a flash of lightning struck the iron pit-head only 16 meters high in preference to three neighboring chimneys from 25 to 40 meters. Part of the electric current went down the winding shaft, which is tubbed with cast iron rings and contains the pipes from the underground pumping engine; and at the level of 210 meters it caused an explosion, without serious consequences, in the pumping engine-house, after which it became dispersed in the sump at a depth of 400 meters. The other portion of the current, which remained on the surface, passed along the wires for the electric bells and telephones, breaking and burning these appliances, and also throwing down the underground manager, who was near the mouth of the shaft, as well as four men engaged on the screens.

Rung off.

[*From the Chicago News.*]

He had made up his mind to propose to the pretty telephone girl.

Clearing his throat, he began: "I would like ——"

But the force of habit was strong upon her, and she interrupted him, saying: "Line's busy."

Afterward she realized her mistake, but the bird which has been permitted to escape from the hand seldom comes back from the bush of its own accord.

LITERARY.

The New Year's *Ladies' Home Journal* gives assurance of a purpose to make that magazine more useful and helpful, and stronger in its literary and artistic features, during 1899 than ever before. It contains a number of practical articles, besides a score of features of lighter interest, and opens with a full-page drawing by W. L. Taylor, illustrating Longfellow's "Village Blacksmith." Early colonial social life is mirrored in "The Most Aristocratic Social Event in America"—the annual ball of the Philadelphia "Assembly," an article that will be read with unusual interest. A close-range view of strong interest is given of Leschetizky, by Cleveland Moffett, who discloses the methods of "The Man Who Taught Paderewski," and Elizabeth G. Jordan tells "What it Means to be a Newspaper Woman," a subject upon which she writes from her own experiences.

McClure's Magazine for January, in two articles on the Lake submarine boat, gives its readers the double sensation of inspecting a really new and extraordinary invention and of following an equally new and extraordinary adventure. No man, since the days of Jonah, has made a more curious voyage than that which Mr. Ray Stannard Baker describes as taken by himself and the artist W. D. Stevens in the Lake boat; and since the creation of Jonah's whale, no more curious craft than the Lake boat, as Mr. Lake himself sets forth its principles, powers and possibilities, has been constructed. The boat drops down to the bottom of the sea, and there traverses the ground precisely like an automobile road-wagon; and from it divers step out through a door on to the sea bottom, as they might step out of a house into a garden, and go spading and hoeing among wrecks. Pictures drawn by Mr. Stevens from life illustrate the articles.

TRADE NOTES.

William J. Murdock Company, 160 Congress street, Boston, Mass., have issued a very artistic advertising specialty describing their "M" telephone receiver. Those who have not received it will be pleased and surprised if they ask for one.

The Connecticut Telephone and Electric Company, of Meriden, Ct., are sending out one of the handsomest calendars of the season. It is neat and small in size and carries a beautiful half-tone engraving in colors, well worthy of a place in any office.

A government telephone line between Indian Head, the naval proving ground, and the Washington Navy Yard has just been completed by Elmer P. Morris, of 15 Cortlandt street, New York. This line is a metallic circuit, 33 miles in length, and is constructed in an unusually substantial and excellent manner, fully meeting the requirements of the government, and the Elmer P. Morris staff has been officially complimented by government representatives.

The Western Electric Company, of Chicago, will send, upon application, copy of Bulletin No. 100, describing fusible cutouts for transformers, lines and switchboards. These cutouts are of the S K C types, and are of the most modern design and construction. They are adapted for any voltage between 1,200 and 6,000 volts. The cutouts for switchboards are of the multiple type, and if one fuse blows out another can be immediately switched into the circuit. The fuses for transformers and lines are mounted on weatherproof boxes, and all details have been carefully worked out.

The James Leffel & Company, of Springfield, Ohio, have been sending out some large orders in Samson turbines during the past two months. They have just completed three 56-inch Samsons, with pulleys, clutches and friction arrangements complete for the Standard Light, Heat and Power Company, of Unadilla, N. Y.; two similar ones, 62-inch turbines, have been shipped to the Dixon Lighting and Power Company, of Dixon, Ill., and two 56-inch turbines to Lyons, Mich. The Kalamazoo Electric Company, of Kalamazoo, Mich., have also sent the Leffel company an order for eight 45-inch Samson turbines. The company are manufacturing a new gas engine, which is attracting very favorable attention among those interested in use of same.

"Cling-Surface" for belts is a material which is to be melted and applied with a brush to the inner surface of the belt, the operation being repeated often until the belt itself is filled. Then the fibers are surrounded and lubricated as though resting in oil bearings and will remain so during the life of the belt, as "Cling-Surface" is said not to oxidize nor rot as grease nor evaporate as oil. In addition, this produces a softness and at the same time a firmness and flexibility which, besides preventing slipping, precludes any cracking of the belt, so that it is certain to last almost a lifetime. One of the first concerns to use "Cling-Surface" was the Erie Railroad Company at the Union Dry-Docks in Buffalo, and the Erie officials assert that they have "saved the cost of taking up 500 belts in the past two years and a half." As all these results have been produced innumerable times, the manufacturers, the "Cling-Surface" Manufacturing Company, Buffalo, N. Y., guarantee complete satisfaction with every pound of their output.

ELECTRICAL APPARATUS ON SHIPBOARD DURING THE LATE WAR WITH SPAIN.

READ BEFORE THE NEW YORK ELECTRICAL SOCIETY, NOVEMBER 14, 1898, BY F. W. ROLLER.

In addressing the society this evening, let me preface my remarks with the statement that much of what I shall have to say is based on hearsay evidence, as is necessarily the case, but that the opinions of the numerous other officers, with whom I have spoken on the subject, seemed to agree so well that I believe you may take the conclusions as generally correct. In the first place we will divide the electrical appliances that we had into two different classes and compare them.

The first of these will include the indicating apparatus, such as the engine room and order telegraphs, speed and direction indicators, helm-angle indicators and the range-finder. All of these instruments are of the galvanometer type, there being a galvanometer at the receiving end with its scale divided in yards, range, degrees, revolutions or arbitrary orders instead of volts or amperes, and actuated by differences of potential produced at their terminals from the sending end. They are, in consequence, delicate in construction and easily get out of adjustment, but they have the advantage of flexibility and possibility of the use of a large number of receiving stations, as well as the minor one of requiring inappreciable amounts of energy.

In general it may be said that their performance was not satisfactory. In some cases, say that of the range-finder, the trouble can not be attributed entirely to electrical reasons. In this instrument where we in reality measure the altitude of a triangle from the known base line (the distance between the two telescopes) and the angles adjacent thereto (those made by the telescopes with the base line when bearing on the target), the base is so very short in comparison to the other two sides that, unless the glasses are very carefully trained and the whole apparatus in perfect adjustment, a very considerable error will arise. It is easy to see how large this error may be when we know that the glasses could only in the most advantageous cases be placed as far as 300 feet apart, and that the minimum distance from the target that it is likely that they will commence to be used is 3,000 yards; the altitude is here 30 times the base. In addition to this, I understand that the device in several cases proved to be unable to withstand the concussion of the great gun fire. Under the circumstances it is natural that their use should have been largely abandoned, and, instead, the secondary battery used. With the great rapidity of fire of this, it was easy to take a large rapid-fire gun, load with common shell, estimate the distance by eye, run up the sights for that, and fire. If a hit was made, that was the range; if not, the shell would be seen as it struck the water, the sights readjusted accordingly, and, the gun having been reloaded in the meantime, another shot taken. It was rarely necessary to make more than two or three trials of this kind before the range was had to a nicety, and then the main battery could be opened up. But let us return to our subject of the instruments.

They had another feature that contributed to their lack of success, which was the difficulty of locating any derangement that might arise. The men were used only to mechanical devices, and a fault that could neither be seen nor detected by the ear seemed to them most mysterious, outside of the fact that the testing, even when understood, was none too simple, and was rendered still more difficult by the surrounding conditions. As a consequence but few troubles made them disgusted, and the instruments got the reputation of being far worse than they were.

There is one other class of electric device that can be said to fall in this first class, in that it employs currents of small strength. This is the electric firing arrangement that was used on some of the rapid-fire guns. But few of the ships were fitted with this. The "Nashville" was one; and although we had, on the whole, the most satisfactory results from it, two or three of the others had, I understand, some trouble from misfires.

This, however, was undoubtedly due to the low battery power furnished to set off the primers, there being a little case holding three small sized dry-cells, secured to the gun-mounts, which were supposed to give all that was required. They did, as a rule, but dry batteries are not any too reliable anyway, and standing exposed in a metal case to the intense rays of the sun day in and day out did not tend to help matters any. A more powerful type of cell would undoubtedly render them perfectly certain in their action, and as the breech plugs fitted for electric firing are far more simple mechanically than the other types, there is little doubt but that they will be permanently retained.

Leaving, now, our first general class, we come to class number two. This includes all appliances requiring considerable amounts of current for their operation, and takes in the incandescent lamps, the searchlights and the motors.

It may appear strange that special stress should be laid here to the incandescent lamp, as its advantages seem obvious, but it is of extreme value in many ways that are not so apparent at first glance. If we take the easy control of all the light from a central point, for instance, here alone is a point of the greatest importance. On a regular man-of-war all of the lights that are out of sight and those necessary for the operation of the guns at night which are fitted with shields to obscure them are grouped on a common "battle circuit," so that under war conditions all of the other circuit switches may be opened at sundown with the perfect assurance that after that there will be no glimmer of light to betray the vessel's position. On the auxiliary vessels that we had there was no such provision, with the consequence that in spite of the vigilance of the officers they were bound to be found sooner or later with an unauthorized light going somewhere.

It was easy then to see them at quite a distance and an enemy's ship would have had a great advantage over them, whether she was chasing or trying to slip by. Another place where the electric light was practically indispensable was for the night signal work.

The regular ships were of course fitted with our standard "Ardois" sets, which consist of a string of four lanterns, each half clear glass and half red, inside of each of which were two lamps, either of which could be lit independently, and, by means of a keyboard, the different combinations that formed the signals made. These were always ready, and it was but a second's work to flash the private signal at any craft that was deemed suspicious before betraying your own position too markedly by turning on the searchlight or going further and opening fire. The other ships had to have a number of ordinary lanterns ready lit, concealed from observation, which they would bend on a pair of signal halliards and hoist when they had a communication to make; an operation requiring considerable time. That this time element was important is illustrated by an incident which came under my observation while on the Havana blockade in the early part of the war. There the captain of one of our auxiliary vessels fired on another one of them one night, fortunately discovering his error before any harm was done, and explained his action the next morning by stating that he only saw the other craft when she was very close to him and thought that she was something trying to get in; that that was "no time for signals where he had all that lantern business to go through, so he fired first and asked questions afterward."

We now come to the second device in our class two, the searchlight. The value of this was proven beyond all possibility of doubt in this war; not only was it valuable, but I think we can go much further and say that if it had not been for it there is a strong probability that the war would not even yet be over.

We learned afterward that at Santiago, leaving aside the practical certainty of night attacks from the harbor of the enemy's torpedo boats, which would have stood an excellent chance of success, Cervera had fully determined to make a night dash to escape. This was rendered an impossibility by the searchlight beams that were kept on the harbor entrance the night through, which made the place as light as day for the ships that were behind the lights, and simply dazzled the eyes of any attempting to get out, rendering the navigation of the tortuous channel exceedingly hazardous and making shooting practically impossible for them. In consequence, he found it, on the whole, better to make his trial in daylight, with the well known result. If a night run had been feasible owing to the lack of the searchlight, there is a strong probability that the majority, at least, of the Spanish ships would have gotten away clear, and if they had succeeded in making Havana, their dislodgment and capture of the town would have been a problem of a far different and more difficult nature. An illustration of the power of the searchlight may be of interest. Of course, for the purpose of "picking up" an object they are of little use beyond a distance of two or, perhaps, three miles, but the light is visible at far greater ranges.

I have more than once, when off Havana, seen on the clouds the reflection of the searchlight that was mounted on the fort at Key West, a distance of over 80 miles, and, not only that, been able to follow the course of the beam as it swung from side to side.

Anticipating a query to that effect, I will say that I do not know of any attempt made to communicate with our vessels by this means.

The last of the power-consuming class, the motors, I have concluded not to enlarge on, as you are probably all familiar from reading the papers with their performance. The motors for ammunition hoists, turret training, ventilating, fan driving, and, in some cases, steering gear, gave results so far more satisfactory than any other method of control and operation that their continued use is firmly established. The few failures that occurred were far less in number than those of their steam-driven equivalents, and were even then, in most cases, traceable more to the lack of familiarity of the men with their apparatus than to any inherent defects of the apparatus. It is needless to go into this any further.

As a result of the foregoing I think we may fairly conclude that, in general, the devices that are included in class number one are, as at present installed, of questionable utility, but that class number two was an unqualified success and a monument to the engineering ability of our electrical profession.

The Montgomery & Chester, Pa., Electric Company have been granted a charter for the construction of a trolley line to run from Phœnixville to Spring City, Pa., then on to Royersford, and possibly to Pottstown. The company is incorporated with a capital of $300,000, and J. J. Ridgway, of Chester, is president. Daniel Mann, William Grebe and C. S. Jarvis, of Philadelphia, are interested.

ADVANCE INFORMATION

New Incorporations.

BUFFALO, N. Y.—The Electropathic Company has been incorporated, to manufacture electrical apparatus; capital, $1,000; directors, Alfred C. Scheu, Helen Z. M. Rodgers and Elbert Rodgers.

RICHMOND, KY.—The Richmond Electrical Company has been incorporated, with a capital stock of $10,000. J. D. Hauss, of Cincinnati, president; French Tipton, Richmond, vice-president; John W. Crooke, Richmond, secretary and treasurer; F. H. Adair, Carlisle, Ky., superintendent.

CHICAGO, ILL.—The Municipal Police Signal Company has been incorporated, with $25,000 capital stock, to manufacture electrical signals.

LOUISVILLE, KY.—The Electric Indicator Company has been incorporated, with a capital stock of $30,000, by J. D. Keen, Ben T. Venderink and C. S. Dodson. The purpose is to manufacture and sell electrical appliances.

WACO, TEX.—The Electrical Construction Company has been incorporated, by E. Rotan, W. W. Seley, S. Sawyer, E. N. Stephenson, J. B. Earle and others, to construct, maintain and operate telephone lines; capital stock, $35,000.

OTTAWA, CAN.—The Metropolitan Electric Company has been incorporated, with a capital stock of $500,000.

New Telephone and Telegraph Companies.

FLORENCE, S. C.—The Florence & Allison Telephone Company has been incorporated, with R. C. Commander, president, and C. Poston, secretary and treasurer; capital stock, $1 000.

DILLON, S. C.—The People's Telephone Company has been incorporated by C. A. Woods, E. L. Moore and John Willcox.

COLVILLE, WASH.—Columbia & Northern Telephone and Telegraph Company has been incorporated, with a capital stock of $15,000.

MEXICO, MO.—The Lafayette Telephone Company has been incorporated by D. P. Moore, M. B. Moore, E. D. Graham and others, to construct and operate a telephone system; capital stock, $12,500.

COLUMBUS, OHIO—American District Telegraph Company has been incorporated by H. D. Bennett, I. F. Miller, W. F. Bardell, G. W. Patterson and A. M. Schayer; capital stock, $50,000.

GREENCASTLE, IND.—Putnam County Telephone Company has been incorporated by J. Richardson, F. G. Gilman, and C. C. Hurst; capital stock, $10,000.

MILFORD, PA.—A telephone line will soon be erected between this place and Mount Pleasant.

STELLA, NEB.—The Interstate Telephone Company has completed its line into this place, and is extending it north, expecting to reach Nebraska City before laying off the workmen for the Winter.

HARRISBURG, PA.—The Pennsylvania Telephone Company has finished its new line between this place and Hummelstown.

OPAL, UTAH—A company has been organized to construct a telephone line between this place and Big Piney. The officers of the company are as follows: President, C. F. Robinson; secretary, Ralph Friend. Work on the new line will commence at once.

HOQUIAM, WASH.—The Sunset Telephone Company, of Tacoma, has been granted a franchise to put in an exchange here, with A. C. Sands as manager.

WACO, TEX.—The Independent Telephone Company has been incorporated to operate telephone and telegraph lines; authorized capital, $75,000; incorporators, S. Sawyer, E. N. Stephenson, J. B. Earll, J. E. Boynton, W. W. Seley, E. Rostan, Waco.

BELLE PLAIN, N. J.—A new telephone line is to be constructed from this place to Woodbine and Dennisville.

CHATTANOOGA, TENN.—The Postal Telegraph company has definitely decided to extend its line from this place to Knoxville.

SAN LUIS POTOSI, MEXICO—A telephone service has been established between this place and San Bartolo, Angostura, Pastora, Rio Verde, Las Tablas, Palmas, Ciudad de Maiz, Alaquine and Cerritos.

FAYETTE, OHIO—The Bell interests and the Harrison Telephone Company are each building a line from Fayette into the northwestern part of Williams County, there making connections with other lines owned by these companies.

HOMESTEAD, PA.—A local telephone company has been organized here.

BOONVILLE, N. Y.—A new telephone line is being constructed here by a company made up of a number of the prominent residents of Lewis County; incorporators, Domser Bros., Jay Gantner and Fred C. Meyers.

HAWESVILLE, KY.—The Cumberland Telephone Company, of Nashville, has begun the building of a telephone line from western Kentucky to Louisville.

SLATEDALE, PA.—The Pennsylvania Telephone Company is building a new telephone line from this place to Tripoli and Deibertsville.

RICHMOND, TENN.—The East Tennessee Telephone Company is putting in a new exchange here in opposition to the local company. Rates will be cut in half.

GENOA, NEB.—The Nebraska Telephone Company proposes, in the Spring, to extend its telephone line from this place to Neligh.

SODUS, N. Y.—The Empire State Telephone and Telegraph Company has decided to build a trunk line from this place to Oswego. Arrangements are also being made for the location of telephone offices at East Williamson and Wallington.

COLUMBUS, OHIO—The Co operative Telephone Company has been incorporated, to operate a local telephone system; authorized capital, $50,000; incorporators, George Riddle, Frank H. Howe, Charles A. Spinny, W. B. Childers, W. B. Earnhart, A. C. Ross, E. H. Reel, George D. Jones, J. S. McLeon, Alfred E. Lee, W. M. Payne, G. D. Owen, A. B. Summers, Charles W. Groff, Edgar J. Pocock, Jonathan F. Linton, F. Siegel, W. J. Davidson, Charles F. Galloway, John F. Fergus.

CRESCENT CITY, FLA.—The Fruitland Peninsula Telephone Company has been incorporated, with W. J. Pierpont, president; Dr. G. E. Walker, secretary; J. W. Miller, treasurer; capital stock, $800.

MASSIES MILLS, VA.—The Massies Mills Telephone Company has been incorporated by W. D. Meeks, James Dickie, J. C. Bentz, M. B. Hughes and others, to do a telephone and telegraph business; capital stock, $2,000.

New Electric Railways.

EAU CLAIRE, WIS.—The Chippewa Valley Electric Railway Company has decided to put in a large power-plant to operate its lines, and will also bid for the contract for city lighting.

NEW CASTLE, IND.—The commissioners of Henry County have granted a franchise to the New Castle Electric Railway Company, consisting of E. B. Phillips, R. Wisehart, Thad. Gordon, D. P. Jennings, Dr. J. F. Thompson and T. B. Millikan.

HARTFORD, CT.—An electric line will probably be constructed between Enfield and Somers.

GOSHEN, IND.—The Indiana Electric Company has completed its interurban line between this place and Elkhart, and is now open for business.

CHICAGO, ILL.—The People's Street Railway Company has been incorporated, with a capital stock of $10,000; incorporators, Joseph W. Latimer, Robert R. Reynolds and J. Guy Latimer.

The United Gas Improvement Company, of Gloversville, N. Y., are erecting a new plant, consisting of generator house and boiler and engine house. The building is about 50 feet wide and 80 feet long. It will be fireproof throughout. The side walls are of brick and the roof framing of steel, which will support slate roof covering. The trusses are clear span—no interior columns—and rest directly on the side walls of brick. The steel work was furnished and erected in place by the Berlin Iron Bridge Company, of East Berlin, Ct.

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DULUTH, MINN., Dec. 1, 1898.

Notice is hereby given that the City of Duluth will receive tenders for the purchase of a telephone franchise in said city, January 16, 1899, the condition of the sale of such franchise to be obtained upon application to the City Clerk of said city. All tenders must be addressed to the Common Council of the City of Duluth, and handed to the City Clerk before 7.30 p.m. of said day.

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616,082 Thermostatic auxiliary fire-alarm system; A. H. Cross, New York—Consists of a street box, a normally closed auxiliary circuit, including a section of fusible wire extending throughout a building, and a compound or thermostatic wire arranged parallel to said fusible wire and normally disconnected from the auxiliary circuit.

616,089 Controller for motor cars; A. P. Dodge, New York, N. Y.

616,110 Electric switch; W. J. Kelly, Boston, Mass.—Consists of a rotatable shaft, a plurality of commutators loosely mounted thereon, clutch mechanisms co-operating with said commutators, actuating means to operate said clutch mechanisms and produce rotation of the commutators, and means to lock the said actuating means to the said shaft.

616,111 Arc-light regular; W. J. Kelly, Boston, Mass.—Consists of a variable resistance compound composed of a series of resistances increasing and diminishing irregularly as described, to enable the arc lamp to be regulated without interfering with its functions, and a circuit controller cooperating with the said variable resistances.

616,120 Railway switch; E. S. Leaycraft, Jersey City, N. J.

616,136 Auxiliary fire-alarm telegraph apparatus; B. Oehmen, New York.

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Kindred.... ...Interests

The Victor Telephone Manufacturing Company, 166 to 174 South Clinton street, Chicago, among other recent orders have just sold to the Chequamagon Telephone Company, of Ashland, Wis., a full 400-number exchange, including everything in the way of telephone equipment.

The Lombard Water-Wheel Governor Company, Boston, report that the demand for their governors is constantly on the increase. During last month they received orders for upwards of 20 governors to regulate 41 water-wheels, which will develop 15,750 horse-power. More than half of this machinery will be used in electric stations—principally in power-transmission plants and electric railway stations—the balance being in textile and other manufacturing plants driven by water-power.

The Central Electric Company, Chicago, is in receipt of a great many flattering comments from the trade on their new general catalogue, of which the following is a sample: "We beg to acknowledge the receipt of a copy of your new general catalogue, and thank you for the same. It is a very complete and fine production in every respect. Kindly send discount sheet." As the catalogue contains a quantity of valuable data, outside of the merchandise illustrated, it is well worthy of careful examination and preservation.

Herbert B. Coho, New York manager of the Eddy Electric Manufacturing Company, announces the following sales during the past week: Nairn Linoleum Works, one 150-kilowatt and one 25 kilowatt generator; United States Galvanizing Company, two 1,400-ampere platers; Bethlehem Silk Company, one 50-kilowatt lighting machine; J. L. Moriarty, 300-light dynamo and gas engine; Geo. F. Blake Manufacturing Company and Knowles Steam Pump Company, motors for pumps; Brill Brothers and Wolfstein & Horwitz, small power plants. The new offices of the Eddy Electric Manufacturing Company, at 143 Liberty street, are always open from eight in the morning until six at night, and anybody desiring estimates is cordially invited to call.

The Western Electrical Supply Company, St. Louis, Mo., have, within a short time, arranged to handle the "Warren" alternators in the western territory. In making this arrangement with the manufacturers, the Warren Electric Manufacturing Company, of Sandusky, Ohio, they were convinced that this type of alternating machinery combines to the best advantage and with moderate price the very salient features of simplicity, durability, high efficiency and close regulation. The machines have no revolving wires, brushes or commutators. The company wish it known that they are prepared to furnish these machines in all sizes, direct from the St. Louis store. The company are also placing on the market the "Western" cutout. This cutout is designed to be placed on the ceiling, or wall, where the wire enters, to take the place of the ordinary main-line cutout as well as the double-pole switch required by the underwriters.

The New York & Ohio Company, of Warren, Ohio, have just issued two especially valuable catalogues describing the Packard lamps and the Packard transformers, both of which are manufactured by them. The catalogue describing the transformer includes a paper by Prof. Dugald C. Jackson, entitled "Transformers and Their Profitable Use." It also contains a paper, entitled "General Instructions for Testing Transformers," by Henry W. Wiswell. The Packard model '98 transformers are also illustrated and described. The catalogue describing the Packard lamps covers the subject completely, and the illustrations of the lamps shown are in full size. The method of illustrating these lamps is believed to be something new, in this country at least, and the vivid impression conveyed should more than recompense the New York & Ohio Company for the expense involved in their making. The lamp catalogue also includes a new table on efficiency and average life of lamps at the various voltages; it is original and instructive. Any one concerned with electric lighting can not afford to be without these handsome booklets.

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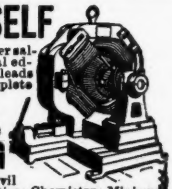

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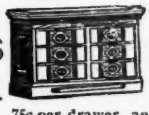

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